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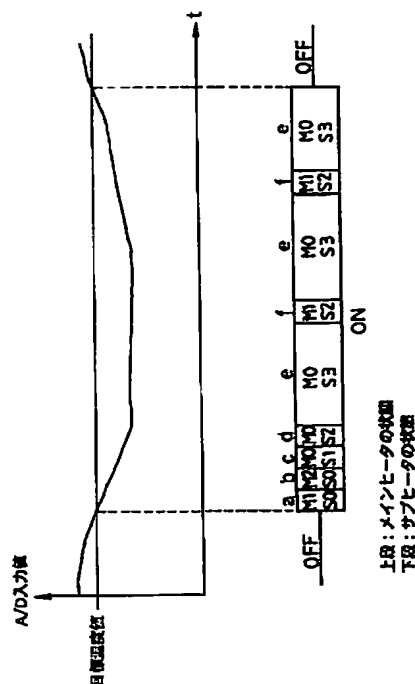
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(54) 【発明の名称】 定着ヒータの制御方法および画像形成装置

(57) 【要約】

【課題】位相制御によらず、定着ヒータによる急激な電流変化を低減することができる定着ヒータの制御方法およびこれを採用した画像形成装置を提供する。

【解決手段】ヒータ温度が目標温度より低下したときの交流電源電圧の印加開始直後に、ヒータ電流を減少させるために、定着ヒータへ印加する交流電源電圧の3半波長分を周期として、間引き数を大から小に変化させていく。2つのヒータを有する場合には、それぞれについて順次これを行う(状態a, b, c, d)。その後、間引き数を0とした印加を行う。この際も、連続する3半波長分を周期として、第1のヒータには1周期の3半波長のうちの1半波長または2半波長分の波形を間引いて通電すると共に第2のヒータには第1のヒータで間引いた半波長分のみ波形を印加する第1の通電パターンを用いる状態fと、一方のヒータにのみ通電する状態e(または状態fの両ヒータの関係を逆にした状態)とを、ヒータ温度が目標温度に達するまで、交互に繰り返す。



【特許請求の範囲】

【請求項 1】 定着ヒータへ印加する交流電源電圧の少なくとも連続する 3 半波長分を周期として、そのうちの 1 または複数の半波長分の波形を間引く制御を採用し、前記定着ヒータへの交流電源電圧の印加開始直後に、前記定着ヒータに対して前記間引き制御による間引き波形を印加した後、間引きのない波形の印加へ移行することを特徴とする定着ヒータの制御方法。

【請求項 2】 請求項 1 に記載の方法であって、3 半波長分を周期として、前記交流電源電圧の印加開始直後に、間引き数 2 として複数周期の印加を行い、その後、間引き数 0 の印加へ移行する定着ヒータの制御方法。

【請求項 3】 請求項 1 に記載の方法であって、前記交流電源電圧の印加開始直後に、間引き数を大から小に変化させた後、間引き数 0 とする定着ヒータの制御方法。

【請求項 4】 請求項 3 に記載の方法であって、3 半波長分を周期として、前記交流電源電圧の印加開始直後に、間引き数 2 として複数周期の印加を行い、ついで、間引き数を 1 として複数周期の印加を行い、その後、間引き数 0 の印加へ移行する定着ヒータの制御方法。

【請求項 5】 請求項 1 に記載の方法であって、前記定着ヒータは、第 1 のヒータと第 2 のヒータとからなり、前記第 1 のヒータと第 2 のヒータに対して交互に通電する際、連続する 3 半波長分を周期として、第 1 のヒータには 1 周期の 3 半波長のうちの 1 半波長または 2 半波長分の波形を間引いて通電し、第 2 のヒータには第 1 のヒータで間引いた半波長分のみの波形を印加する定着ヒータの制御方法。

【請求項 6】 請求項 5 に記載の方法であって、請求項 5 に記載の第 1 および第 2 のヒータへの第 1 の通電パターンと、第 1 および第 2 のヒータの関係を逆にした第 2 の通電パターンとを交互に切り替える定着ヒータの制御方法。

【請求項 7】 請求項 6 に記載の方法であって、第 1 のヒータに対する N_m 個の半波長の連続印加と、第 2 のヒータに対する N_s 個の半波長の連続印加とを交互に繰り返す制御と等価な制御として、 $2N_s - N_m$ 個の半波長分、前記第 1 の通電パターンで第 1 および第 2 のヒータへの通電を行い、ついで、 $2N_m - N_s$ 個の半波長分前記第 2 の通電パターンで第 1 および第 2 のヒータへの通電を行うことを交互に繰り返すことを特徴とする定着ヒータの制御方法。

【請求項 8】 請求項 5 に記載の方法であって、請求項 5 に記載の第 1 および第 2 のヒータへの第 1 の通電パターンと、第 1 および第 2 のヒータの一方のみへの間引き数 0 の通電とを交互に切り替える定着ヒータの制御方法。

【請求項 9】 トナー像を用紙上に定着させる定着器を有する画像形成装置であって、前記定着器の定着ヒータとしての第 1 および第 2 のヒータと、

該第 1 および第 2 のヒータに対する交流電源電圧の印加をそれぞれ独立に制御する第 1 および第 2 のスイッチング手段と、

該第 1 および第 2 のスイッチング手段のスイッチングを制御する第 1 および第 2 のスイッチング手段と、前記定着ヒータのヒータ温度を検出する温度検出手段と、

交流電源電圧のゼロクロス点を検出するゼロクロス検出手段と、

前記温度検出手段により検出された温度が予め定められた温度より低下したとき、前記ゼロクロス検出手段によるゼロクロスの度に、順次、予め定められた手順で前記第 1 および第 2 のヒータに対して半波長単位の前記電源電圧の印加の是非を決定し、該決定結果に基づいて前記第 1 および第 2 のスイッチング手段を制御する制御手段とを備えたことを特徴とする画像形成装置。

【請求項 10】 請求項 9 記載の画像形成装置において、前記第 1 のヒータと第 2 のヒータとは、発熱強度の分布を異にすることを特徴とする画像形成装置。

20 【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、静電式複写機、プリンタ等の画像形成装置に係り、特に、その定着ヒータの ON/OFF による突入電流を含めた電流の変動を低減させるそのヒータ制御方法に関するものである。

【0002】

【従来の技術】 従来、この種の定着ヒータには比較的消費電流の大きいハロゲンランプが使用されており、その ON 時には非常に大きな突入電流の発生がある。特に、ハロゲンヒータの特性上、ハロゲンヒータ自身の温度が高いときはその抵抗値が大きく、低いときには抵抗値が小さくなる。通常、ヒータ温度が予め定められた温度より低くなった場合にハロゲンヒータを点灯するので、点灯直後には大きな突入電流が流れることになる。

【0003】 図 5 に電圧変動説明図を示す。一般的に、電源コンセント側から供給電源を見た場合、比較的小さな電源インピーダンス (R_s) 7 が存在する。このため、電源に接続された機器（ここでは、複写機）の消費電流 I が大きく急に变化したときは、電源電圧 V の変動が発生し、その大きさは、急激な電流変化を ΔI とすれば、急激な電源変動分は $\Delta V = R_s \times \Delta I$ と評価できる。例えば、このコンセントラインに照明器具 9 が接続されていれば、急激な電圧変動は照明のチラツキとなって現れてくる。

【0004】

【発明が解決しようとする課題】 ここで、具体的な定着器の構成に関連して、本発明の課題を説明する。

【0005】 図 1 は、本発明が適用される定着器の概略図であり、この中の 1 はヒータローラ、2 は加圧ローラを表わす。この両ローラ 1、2 間に、トナー画像が現像

された用紙3を通過させることにより、トナー画像を用紙3上に熱融着させることができる。ヒータローラ1内には、メインヒータ4とサブヒータ5が図示された形で装着されている。

【0006】すなわち、図2に示すように、メインヒータ4の発熱強度分布は中央付近にピークがあり（図2A）、一方、サブヒータ5は両端部側にピークがある（図2B）。この2本のヒータを交互に点灯させ、そして各ヒータの点灯時間を調節することで、ローラ表面上での温度分布を均一化させる（図2C）。

【0007】図3はスタンバイ時のヒータへの通電電流波形を示すが、この中でP1は大きな電流変化がある部分である。図5で前述したように、この電流変化が、供給電源そのものの電圧変動を生じさせ、同一電源に接続されている照明等のチラツキなどの弊害を引き起こしてきた。近年、このような機器の電流変化による電圧変動を低減させようという社会的な要請が強まっている。

【0008】画像形成装置の定着器に使用されるハロゲンヒータによる急激な電流変化を低減するための方法を、本発明は提供するものであるが、具体的には、図3内に示された以下の急激な電流変化部分を緩和することである。

【0009】1、ハロゲンヒータの突入電流部（図3内のP1、P2部）

2、2本ヒータ構成の定着器でヒータを交互に切り替えたときの電流変動部（図3内のP3、P4）

このような問題点を解決するために、図4に示す様な位相制御によるヒータへの通電が考えられる。ヒータON直後の突入電流発生時のような急激な電圧変動防止には、電圧の実効的な大きさを徐々に大きくしていけば良いから、例えば図4内メインヒータ4への通電波形に示した形で、まず、1半波長内の通電時間を、 t_{m1} 、 t_{m2} 、 t_{m3} 、…、 t_{mc} へと徐々に、拡大していけば良い。サブヒータ5についても同様に t_{s1} 、 t_{s2} 、 t_{s3} 、…、 t_{sc} とする。この中で、メインヒータ4の定常状態通電位相角に相当する t_{mc} およびサブヒータ5の t_{sc} は、一定値である。

【0010】この値は、図3内の切り替え波形に戻って考えると、この場合のメインヒータ4の通電電力は T_m/T 、サブヒータは T_s/T の割合であるので、この値に従って t_{mc} 、 t_{sc} を調整することが可能である。

【0011】このような構成により、事実、理想に近い穏やかな電流変化をさせることも可能である。しかし、この方法には、以下の様な欠点も存在する。

【0012】1、位相角（即ち、上述 t_{mc} 、 t_{sc} などの時間）を決めるためのタイマ機構など、そのハードウェアが複雑であること、そして、それらの設定、起動などの制御上の複雑性も同様に高くなると考えられる。

【0013】2、電源周波数の異なる地域（50Hz、60Hzの地域差）に対しては、各々別の設定をしなけ

ればならず、その切り分けに対する管理上の煩雑さを生ずる。

【0014】3、図4を見ても明らかな様に、ヒータへの通電がゼロクロス起点ではなく、半波長内の中間でONされているため、高調波電流の発生という弊害を生み出す。この高調波電流は、電源周波数の高次波（数倍～数十倍）で発生し、これは給電線を通して接続された他の機器へ、ノイズとして妨害を与え、誤動作、故障の原因となる。従って、位相制御の場合には、この電源高調波電流を低減するため、別途、大容量のチョークコイルを挿入する、等の対応が必要となっている。

【0015】本発明は、このような問題点に鑑み、これを克服できる方法を提案するものである。すなわち、本発明は、位相制御によらず、定着ヒータによる急激な電流変化を低減することができる定着ヒータの制御方法およびこれを採用した画像形成装置を提供するものである。

【0016】

【課題を解決するための手段】本発明による定着ヒータの制御方法は、定着ヒータへ印加する交流電源電圧の少なくとも連続する3半波長分を周期として、そのうちの1または複数の半波長分の波形を間引く制御を採用し、前記定着ヒータへの交流電源電圧の印加開始直後に、前記定着ヒータに対して前記間引き制御による間引き波形を印加した後、間引きのない波形の印加へ移行することを特徴とする。

【0017】これによって、定着ヒータへの交流電源電圧の印加開始直後の突入電流の発生を防止することができる。また、位相制御によらず、ヒータ電流がゼロクロス起点から印加されるため、電源ライン上における電源高調波の発生を殆どなくするとともに、制御ハードウェアを比較的単純化することができる。

【0018】具体的には、3半波長分を周期として、前記交流電源電圧の印加開始直後に、間引き数2として複数周期の印加を行い、その後、間引き数0の印加へ移行する。

【0019】他の見地によれば、本発明の方法は、前記交流電源電圧の印加開始直後に、間引き数を大から小に変化させた後、間引き数0とするものである。

【0020】例えば、3半波長分を周期として、前記交流電源電圧の印加開始直後に、間引き数2として複数周期の印加を行い、ついで、間引き数を1として複数周期の印加を行い、その後、間引き数0の印加へ移行する。

【0021】前記定着ヒータが、第1のヒータと第2のヒータとからなる場合、前記第1のヒータと第2のヒータに対して交互に通電する際、連続する3半波長分を周期として、第1のヒータには1周期の3半波長のうちの1半波長または2半波長分の波形を間引いて通電し、第2のヒータには第1のヒータで間引いた半波長分のみの波形を印加する。

【0022】この場合、例えば、このような第1および第2のヒータへの第1の通電パターンと、第1および第2のヒータの関係を逆にした第2の通電パターンとを交互に切り替える。

【0023】具体的には、第1のヒータに対する N_m 個の半波長の連続印加と、第2のヒータに対する N_s 個の半波長の連続印加とを交互に繰り返す制御と等価な制御として、 $2N_s - N_m$ 個の半波長分、前記第1の通電パターンで第1および第2のヒータへの通電を行い、ついで、 $2N_m - N_s$ 個の半波長分前記第2の通電パターンで第1および第2のヒータへの通電を行うことを交互に繰り返す。

【0024】別の方法として、上記の第1および第2のヒータへの第1の通電パターンと、第1および第2のヒータの一方のみへの間引き数0の通電とを交互に切り替える方法も考えられる。

【0025】本発明による画像形成装置は、トナー像を用紙上に定着させる定着器を有する画像形成装置であって、前記定着器の定着ヒータとしての第1および第2のヒータと、該第1および第2のヒータに対する交流電源電圧の印加をそれぞれ独立に制御する第1および第2のスイッチング手段と、該第1および第2のスイッチング手段のスイッチングを制御する第1および第2のスイッチング手段と、前記定着ヒータのヒータ温度を検出する温度検出手段と、交流電源電圧のゼロクロス点を検出するゼロクロス検出手段と、前記温度検出手段により検出された温度が予め定められた温度より低下したとき、前記ゼロクロス検出手段によるゼロクロスの度に、順次、予め定められた手順で前記第1および第2のヒータに対して半波長単位の前記電源電圧の印加の是非を決定し、該決定結果に基づいて前記第1および第2のスイッチング手段を制御する制御手段とを備えたことを特徴とする。

【0026】この画像形成装置において、好ましくは、前記第1のヒータと第2のヒータとは、発熱強度の分布を異にする。

【0027】

【発明の実施の形態】以下、本発明の好適な実施の形態について、詳細に説明する。

【0028】本発明が適用される定着器の概略構成については、図1および図2を参照して上述したとおりである。すなわち、定着ヒータとしてのメインヒータ4とサブヒータ5の2本のヒータを原則として交互に点灯させ、各ヒータの点灯時間を調節することで、ヒータローラ表面上での温度分布を均一化させる。

【0029】図3に示した両ヒータへの通電パターンは本発明によるものではないが、この通電パターンを用いて、2本のヒータを利用することの意義を簡単に説明する。

【0030】通紙のないスタンバイ時には、図3に示し

た様にサブヒータ5に比較してメインヒータ4の通電は短く、両ヒータが交互点灯される。また、通紙時であって、小さなサイズ用紙の場合はヒータローラの中央付近の潜熱が奪われるから、メインヒータ4の点灯時間を長くする。このようにして、スタンバイ時、コピー時などのモード毎に交互点灯時間を切り替えてヒータローラ上の熱分布を均一にする様にし、特に小サイズ紙通紙の場合では、ヒータローラ上の非通紙部分、即ち（両サイドに近い部分）の不必要な昇温を防止し、ヒータローラ端部の軸受けや駆動ギア部分の過昇温による損傷を防止する。

【0031】本実施の形態では、平均電流の急激な変動を抑止しつつ、このような2本のヒータの発熱制御と等価な結果を得ようとするものである。

【0032】図6に、本発明による「波数制御」の一例を示す。これは、ハロゲンヒータの突入電流部に対して実施される。突入電流部は、ヒータON直後の立ち上がり部であり、平均的に、徐々に電流が増加するようにすればよい。そのために、この例では、メインヒータONから開始して、まず期間aに示した様に3半周期に1回の半波長分を周期的に通電する（これを「1/3半波」と呼ぶ）。次に、期間bに示したように、3半周期に2回の半波長分を周期的に通電する（これを「2/3半波」と呼ぶ）。続いて、メインヒータを必要な時間だけ全周期分通電してもよい（これを「全周期」と呼ぶ。図示せず）。この後、メインヒータ4を消灯し、サブヒータ5のみの通電を続けるが、同様に、まず、1/3半波の期間c、次に、2/3半波の期間d、その後、間引きなしの全周期の期間eとなる。

【0033】即ち、これは、立ち上がり時に平均電流を、段階的（ここでは3段階）に小さい方から順次大きくなる方向へ切り替えて行き、最後に全周期へ移行するようにするということである。言い換えれば、立ち上げの最初は最も突入電流が多いため、3半波長周期のうち2半波長分間引き（期間aまたは期間c）、その後ヒータ線が少し暖まった所で、突入電流も減少してくるため、3半波長周期のうち1半波長分間引く（期間bまたは期間d）。そして最後に、間引き数0の全周期印加に切り替えるということになる。

【0034】ここで、3半波長周期を基準に波数間引きを行うことが好ましい理由を説明する。例えば2半波長（通常の1周期のこと）を基準としてみれば、これから、1半波長分間引くと半波整流波形と同じ直流成分となってしまう。これでは直流点灯となり、ハロゲンヒータではこのような駆動は推奨されていない。また、3半波長周期より長い周期での間引きは、照明等のチラツキと言う性格上、その間引き操作自体、人の目にチラツキとして感じ易くなってくる。従って、2半波長以外が一番短い周期、即ち3半波長周期で考えるのが一番妥当と言うことになる。事実、この3半波長周期の間引きに於

いて、実際に照明を接続しチラツキを観測した場合、実験的にもチラツキ感は殆ど感じられなかった。

【0035】しかしながら、3半波長周期より長い周期での間引きでも従来よりは効果が認められるので、後述するように、本発明は、これを排除するものではない。

【0036】次に、2つのハロゲンヒータ切り替え時、すなわち、メインヒータ4とサブヒータ5の一方から他方への切り替え時に生じる電流変化（図3内のP3、P4部）の軽減方法について述べる。

【0037】従来、2本ヒータの周期的な切り替えは、図3に示した様に、一方の次に他の一方と言うように比較的大きな周期（数百mSec～数Sec程度）で行っていた。本発明では、この切り替えを極限にまで早くするという考えで行う。

【0038】図7に、本実施の形態における切り替え方法を示す。まず、状態M1に示すように、メインヒータ4を半波長通電し、それに続く2半波長は状態S2に示すようにサブヒータ5のみ通電するという制御を繰り返す。このようにした合成電流は、状態M1+S2に示すとおり、2つのヒータ切り替えによる電流変動は3半波長周期毎に細かく分解された形となる。3半波長周期の変動による電源電圧変動は、微小時間間隔で生じるため、事実上、照明などのチラツキとして感知されない。実際、このような考え方を適応すれば、2本のヒータの切り替えを、従来は、図8に示した様にメインヒータ4にNm個の連続的な半波（M3）印加後、サブヒータ5がNs個の連続的な半波（S3）印加の繰り返しで行っていたとすれば、これと等価の3半波長周期毎のヒータ切り替えは、図9に示した様にメインヒータ4の3半波長内の1半波長通電（図7内M1状態）と、サブヒータの3半波長内の2半波長分通電（図7内S2状態）とを合成するパターン、即ち、図7のM1+S2状態に示した通電パターンとなる。この通電パターンは、2Ns-Nm個の半波長分（図9内A部）継続する。

【0039】次に、メインヒータ4の2半波長通電（図7内M2状態）と、サブヒータ5の1半波長通電（図7内S1状態）とを合成するパターン、即ち、図7のM2+S1状態に示した通電パターンで、2Nm-Ns個の半波長分印加（図9内B部）を行う。このような、図9内A、B部の繰り返しが、従来の切り替えパターン（図8）と等価である。その理由は、（1）図9内A、Bを1周期と見たときの繰り返し周期は、Nm+Ns個の半波長分で、従来パターン（図8）の場合と同じであること。

【0040】（2）図9内A、B部内のメインヒータ4の全印加半波の数はNm、サブヒータ5のそれはNsで、従来パターンの1周期内の通電半波数と同じである。

【0041】（3）（1）、（2）より、従来パターンの印加と比較して、各々のヒータの発熱量は、周期毎で見れば明らかに等しい。

【0042】更に、考えを進めて、図9内A、B内部の3半波長周期内の変動は問題にならないことは既に述べたが、同図内A部とB部との平均電流差は問題にはなる。しかし、この量を評価してみると、A部内の平均電流は、 $(1/3)I_m + (2/3)I_s$ となり、また、B部内の平均電流は、 $(2/3)I_m + (1/3)I_s$ となる。従って、両者A、B部分の差は、

$$((1/3)I_m + (2/3)I_s) - ((2/3)I_m + (1/3)I_s) = (1/3)(I_s - I_m)$$

となり、従来の場合の1/3になっていることが分かる。（ここに、 I_m は、メインヒータ4へ全周期印加したときの定常電流値、 I_s は、サブヒータへのそれとする。）上記の特別な場合で、 $2N_m \leq N_s$ であるときを考えてみる。この場合、図9のB部の半波数が負になる。そこで、図10に示すように3Nm半波長分サブヒータ5をS2状態印加にし、メインヒータ4はM1状態印加にした波形を加え、その後、サブヒータ5のみのS3状態を $(N_s - 2N_m)$ 半波分印加する。この場合を考えてみても、繰り返し周期は、 $T = N_m + N_s$ （半波の個数）であるし、その周期T内のメインヒータ4に印加される半波数はNm、サブヒータに印加されるそれはNsで、従来の切り替えのときと変わらない。更に、図10内A'、B'部間の平均電流差は、

$$((1/3)I_m + (2/3)I_s) - I_s = (1/3)(I_m - I_s)$$

となって、従来の場合（図8）の1/3になっていることが分かる。

【0043】 $2N_s \leq N_m$ の場合も同様に考えれば良い。すなわち、図示しないが、図10内のA'部をS1+M2状態、B'部をM3状態と考える。また、このときのA'部の半波数を3Nsとし、B'部の半波数をNm-2Nsとする。この場合のA'、B'部間の平均電流の差は、

$$((1/3)I_s + (2/3)I_m) - I_m = -(1/3)(I_m - I_s)$$

となり、符号は反転するが、やはり、電流差の絶対値は従来の場合の1/3になっていることが分かる。

【0044】要するに本実施の形態では、3半波長の周期内において、ヒータ立ち上げ時は波形を間引くことによりその平均電流が低い状態より立ち上げると言うことと、ヒータ切り替え時は、3半波の周期内でメインヒータ4とサブヒータ5とを、1半波とそれに続く2半波（1周期）の割合でスイッチングすれば、両ヒータ間の電流差によって引き起こされる電源変動周波数が高くなり、結果として、その電源に接続された照明等のチラツキが人の目には、感じなくなることを利用しているといえる。

【0045】図11は、上述した「波数制御」を実現するための回路図である。

【0046】この図中、THは、ヒータローラ（図1内

1)の温度を検知するサーミスタ等の温度センサ(図1内6)であり、これは抵抗R1に接続され、その分圧電位は、CPU内のアナログ入力端子A/Dに入力されている。A/D端子に与えられた信号は、アナログ/デジタル変換され、CPU内で処理される。CPUのINT入力端子には、交流電源電圧のゼロクロス点に対応するゼロクロスパルス(図13参照)が入力されている。このゼロクロスパルスは、電源の交流電圧入力に基づいて、フォトカプラPC1および比較器COMにより生成される。

【0047】ゼロクロスパルスの立ち下がりに応じてCPU内部の割り込みルーチン(後述)が起動され、このゼロクロス信号立ち下がり直後に、所定のタイミングで、それぞれメインヒータ4、サブヒータ5を点灯させる信号OUT1、OUT2が出力される。

【0048】例えば、OUT1出力がHレベルのときには、トランジスタTR1がOFFとなり、ホトトライアックPT1の発光側は消灯している。PT1の受光側ホトトライアックもOFFであるのでトライアックT1のゲート電流は流れないから、トライアックT1はOFF状態となり、メインヒータ4は消灯となる。なお、本実施の形態において、トランジスタTR1とホトトライアックPT1とトライアックT1とは「スイッチング手段」を構成する。

【0049】反対に、OUT1がLレベルのときは、上述と逆の動作をし、トランジスタTR1はON、ホトトライアックPT1の発光ダイオードは点灯し、受光側ホトトライアックはONする。トライアックT1のゲートへは、PT1の受光側が導通するから、抵抗R2またはR4によって限流されたゲート電流が供給される。従って、トライアックT1は導通となって、メインヒータ4は点灯する。

【0050】トライアックT1に並列に接続された抵抗R6とコンデンサC1の接続は、いわゆるスナバ回路であり、外来ノイズなどの影響によって電源電圧の急激な変化があったとき、トライアックT1が自立的にONするのを防止するためのものである(抵抗R7とコンデンサC2についても同様)。

【0051】サブヒータ5の点灯を制御するOUT2出力の流れも、上記と同じである。

【0052】以上、説明した回路によって行われる制御の実例を説明する。ここでは、メインヒータ4とサブヒータ5の切り替え時の2つの通電パターンを図10の状態A'、B'に対応するものとしたが、適用する対象等に応じて、図9に示したような別の通電パターンの組合せとすることができる。

【0053】図12に示した様に、図11内のCPU A/D入力値、即ち、ヒータローラ1の温度に対応した信号が、目標温度より上回っているとき(ローラ温度が高いとき)には、メインヒータ4およびサブヒータ5は、

共にOFFである。また、下回ったときには、図12に示した様に、状態a→b→c→d→eからf→e→f→eを繰り返す形で、ローラ温度が目標温度値を上回るまでヒータ点灯制御する。この内の状態aとは、前述した様に、図7に示すメインヒータ4のM1通電(3半波長中1半波長ON)状態で、サブヒータ5はOFFである。状態bは、メインヒータ4がM2通電(図7内のS2波形)、サブヒータ5がOFFである。状態cは、メインヒータOFF、サブヒータ5はS1である。状態dは、メインヒータ4はOFF、サブヒータ5はS2である。

【0054】この様に、状態a、b、c、dで突入電流に対する各ヒータの電流変化を緩和させる。これについては、図6に示した内容と同じであるので、既に説明したとおりである。それ以降の状態e、fの繰り返しについて言えば、状態eは、メインヒータ4はOFFで、サブヒータ5は全周期ON(S3)である。状態fは、メインヒータ4がM1通電でサブヒータ5がS2の合成通電である。このパターンは、図7に示したパターンと同一であって、これについても既に説明したとおりである。要するに、これは、メインヒータ4とサブヒータ5の切り替え時に生ずる切り替え電流変化を低減するための操作である。

【0055】図14に、上述の制御を実現するためのソフトウェア手順の一例を表すフローチャートを示す。

【0056】CPU(図11)に対する割り込み入力INTに対しては、図13に示したゼロクロスパルスが与えられているのは既に述べた。このゼロクロスパルスの立ち下がりによって、CPU内処理に割り込み動作が掛かり、図14のフローに示した手順が実行される。

【0057】まず、A/D入力値が、目標温度より高い場合は、判断S141により処理はN側に流れて、カウンタa、b、c、d、e、fにそれぞれの初期値0がセットされる(S142)。また、OUT1、OUT2に各々1がセットされ(S143)、これによってメインヒータ4およびサブヒータ5は共にOFFされる。カウンタa、b、c、d、e、fは、図12に示したヒータON時の状態a、b、c、d、e、fの各々の継続時間を決めるカウンタで、それらはゼロクロスパルスの数、つまり、電源半波の数で管理される。

【0058】以上、ローラ温度が目標より高いときの処理を述べたが、A/D入力値が目標温度より下回った

(温度が低い)値を示したならば、割り込みが掛かる毎にフロー内S141で判断し、今度は、そのY側に処理が流れる。その時点で、間引きカウンタTOに、1が加算される(S144)。この間引きカウンタTOは、0→1→2→0→1→2と、割り込みによりフローのこの部分を通過する都度、状態が一つ進み三つの状態の巡回を続ける。判断S145で、カウンタ値が3になったとき、初期値0に戻す様にしている(S146)。このカ

ウンタTOは、以降の処理中で、3半波長中のどの位置の半波長を指すのかの指示ポイントの役目を果たす。

【0059】判断S147で、aカウンタの状態を見て、予め定めた規定値Aに達していなければ、即ち、図12内のa状態であればN側へ処理が流れ、aカウンタを1カウントアップさせる(S138)。ここに、規定値Aは状態aにおける半波の個数である(後述する他の規定値についても同様)。次に判断S149で、前述の間引きカウンタTOの値を確認する。この値が0であれば、メインヒータ4をONし(S150)、それ以外の値1または2であれば、メインヒータ4、サブヒータ5共にOFF状態とする(S151)。

【0060】ヒータ温度が目標温度より低いときであって、INT入力にゼロクロスパルスの立ち上がりが入る都度に、間引きカウンタTOが巡回(0→1→2→0→...)され、かつaカウンタがその規定値Aに達していなければ、判断部S149をその都度通過し、メインヒータ4を3半波に1半波分のみ周期的にONすることになる。判断部S149では、図7内に示した通電状態M1を作り出していると言える。aカウンタが規定値Aに達すれば、図12に示した状態aを終了して、状態bに移行する。すなわち、フロー内S152でbカウンタの状態を確認し、その規定値Bに達していなければ、N側に処理が流れbカウンタを1カウントアップし(S153)、判断S154で間引きカウンタTOの値が、0または1のときのみメインヒータ4をONする(S155, S156)。これは、図7に示した通電状態M2を実現していると言える。

【0061】以上、同様に判断部S157では図12内のc状態であるかどうかを見て、そうであれば判断S158でcカウンタを1カウントアップし、間引きカウンタTOを見て(S159)、間引きカウンタTOが0のときサブヒータ5のみONしS1状態(図7内)を実現する(S160, S161)。そして、次の判断S162ではd状態を判断し、dカウンタの1カウントアップ(S163)の後、判断S164でサブヒータ5のみをS2状態とする(S165, S166)。更に、次の判断S167ではe状態を判断し、eカウンタの1カウントアップ(S168)の後、サブヒータ5のみをS3状態とする(S169)。

【0062】以上で、図12内のa, b, c, d, e状態を完了する。すなわち、図6に示した一連の立ち上がり部シーケンスを終結したことになる。

【0063】次の判断S170では、図12内のf状態であるかどうかを判断する。fカウンタがその規定値Fに達しない間、処理はN側に流れ、fカウンタを1カウントアップし(S171)、判断S172で間引きカウンタTOを確認して、その値が0であればメインヒータ4のみをONし(S174)、それ以外は、サブヒータ5のみをONする(S173)。結果としてメインヒータ

M1状態と、サブヒータS2状態が合成された形のM1+S2(図7内参照)の通電状態となる。

【0064】また、このfカウンタが規定値Fに達したときは、判断S170で処理がY側に流れeカウンタおよびfカウンタに初期値0が再セットされる。その結果、次のINT割り込みでは、判断S167のeカウンタの規定値到達が解除されてることになるので、もう一度e状態、即ち、サブヒータ5がON(S3状態)となって、f→e→f→...と、この2状態が繰り返されることとなる。

【0065】この様にして、図12内に示したヒータの点灯状態が実現できることが示された。

【0066】なお、a~fカウンタは、上記と異なり、それらの規定値A, B, C, D, E, Fを初期値として設定した後、減数していくことにより、各カウンタ値が0に達したか否かを調べるようにしてもよい。

【0067】以上の実施の形態によれば、次のような格別な効果が得られる。

【0068】(1)制御ハードウェアが比較的単純となる。例えば、ヒータ電流を抑制する手段としては、前述した様に一般的に位相制御方式が挙げられるが、この場合、電源電圧のゼロクロス点からタイマを設定してヒータをONすべき位相角(半波長の時間より充分短い時間間隔での時間)を指定するパルスを発生させる必要がある。これらは制御自体の複雑性とタイマ機構等のハードウェアを用意しなければならないという欠点を有する。本発明のような「波数制御」であれば、ゼロクロス起点でヒータをONするのみであるため、位相を決定するタイマが不要となる。また、その分それらの設定、起動等、制御上の複雑性は減少する。

【0069】(2)位相制御と比較したときの他の利点は、「波数制御」の場合、ヒータ電流がゼロクロス起点から印加されるため、電源ライン上における電源周波数の高次の周波数の電流変化、いわゆる電源高調波の発生が殆どないということである。通常、このような電源高調波の発生を押さえるために、ヒータと直列に大容量のインダクタンス(チョークコイル)を挿入したりすることが必要となるが、これは余計な電気部品の追加によるコスト上昇を招来し、またその設置場所の確保の要請が機械のコンパクト化を妨げる原因になっていた。

【0070】以上では、本発明の「波数制御」に関する典型例を示したが、以下の形の変形も考えられる。

【0071】図6には突入電流を緩和するための例を示した。例えば、この中の状態bやdがなく、1/3半波のみから全周期波形への移行であっても、やはり電流変動の大きさを減らすと言う意味で一定の効果を有する。同様に、状態aまたはcがなく、状態bまたはdのみの場合も同じことが言える。

【0072】要するに、この立ち上げ時に3半波長単位の周期の中から、1または2半波長分間引くことで平均

電流値を減らして突入電流の大きさを減らすことのできる全ての組み合わせについてを本発明は含んでいる。

【0073】図9には、メインヒータ4とサブヒータ5の交互点灯、いわゆるフリッカリング点灯の場合の例を示したが、これについても同様に、3半波長単位の周期の中から1または2半波長間引いた波形を用いた形のもので、サブヒータ5およびメインヒータ4において可能なもののあらゆる組合せの中で、従来の全周期印加による切り替え電流差を減少させるものであれば本発明の範囲内である。

【0074】例えば、以上の説明では、主として3半波長を基準とする場合について説明したが、図15に示すように、4半波長周期、5半波長周期、7半波長周期、11半波長周期等の各々について、図6及び図7のような波数制御も可能である。

【0075】さらには、単一のヒータのみを用いる場合にも、図6に示したような波数を次第に増加させていく制御は有効である。

【0076】

【発明の効果】本発明によれば、位相制御によらず、ハロゲンヒータによる急激な電流変化を低減することができるので、制御ハードウェアを比較的単純化することができる。また、ヒータ電流がゼロクロス起点から印加されるため、電源ライン上における電源高調波の発生を殆どなくすることができる。

【0077】

【図面の簡単な説明】

【図1】本発明が適用される定着器の概略図である。

【図2】図1の定着器のメインヒータとサブヒータの発熱強度分布を示すグラフである。

【図3】図1の定着器のメインヒータとサブヒータの通*

* 電状態の一例を示すタイミング図である。

【図4】位相制御によるヒータへの通電を説明するためのタイミング図である。

【図5】機器の電流電動に伴って生じる電圧変動を説明するための回路図である。

【図6】本発明の実施の形態におけるヒータ立ち上げ時の波数制御の一例を示す電流波形図である。

【図7】本発明の実施の形態におけるメインヒータとサブヒータの切り替え時に用いる通電パターンを示す電流波形図である。

【図8】メインヒータとサブヒータの従来の切り替え方を示す説明図である。

【図9】図8と等価な本発明の実施の形態におけるメインヒータとサブヒータの通電状態を示す説明図である。

【図10】図9のメインヒータとサブヒータの通電状態の変形例を示す説明図である。

【図11】本発明の実施の形態におけるメインヒータとサブヒータの通電状態を実現するための回路を示す回路図である。

【図12】図11の回路によって行われる制御の実例の説明図である。

【図13】図11の回路で検出される電源電圧のゼロクロスパルスの説明図である。

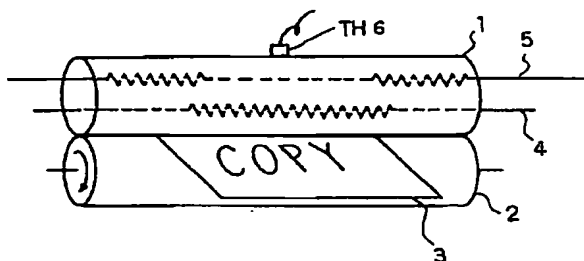
【図14】図11のCPUによって実行される割り込み処理の一例を示すフローチャートである。

【図15】本発明の実施の形態の変形例を示す波形図である。

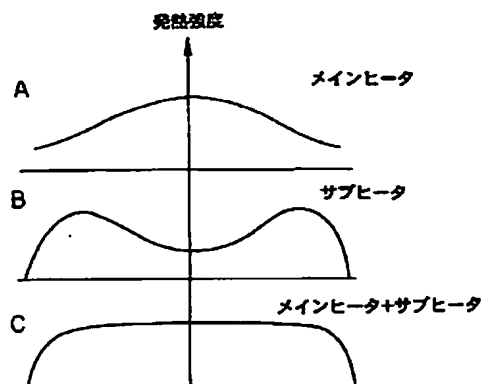
【符号の説明】

1…ヒータローラ、2…加圧ローラ、3…用紙、4…メインヒータ、5…サブヒータ、6…温度センサ。

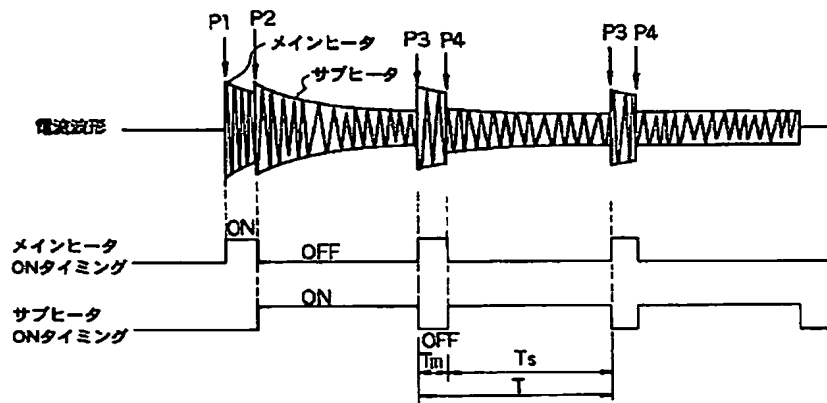
【図1】



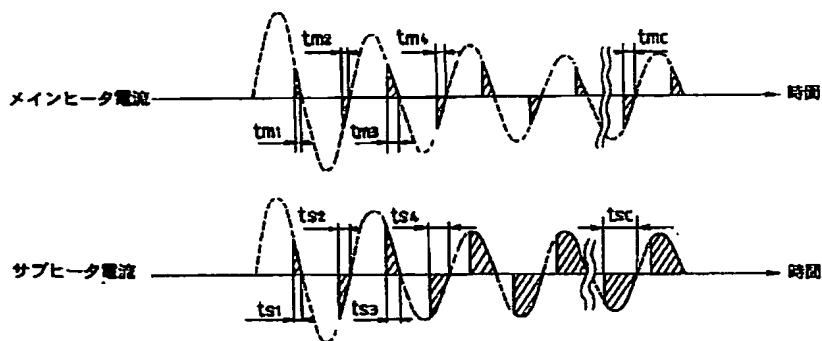
【図2】



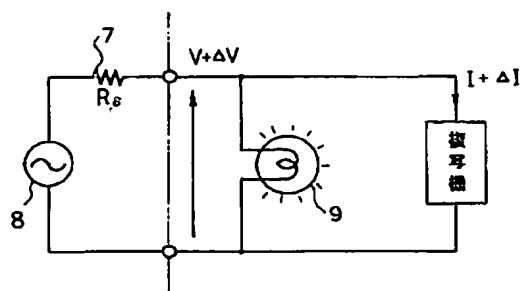
【図3】



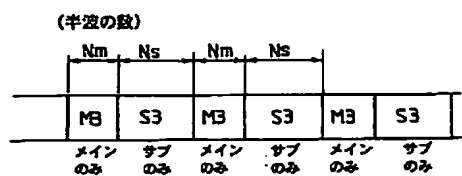
【図4】



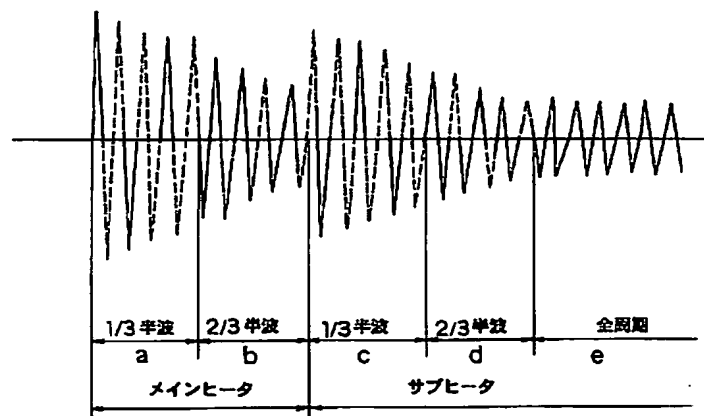
【図5】



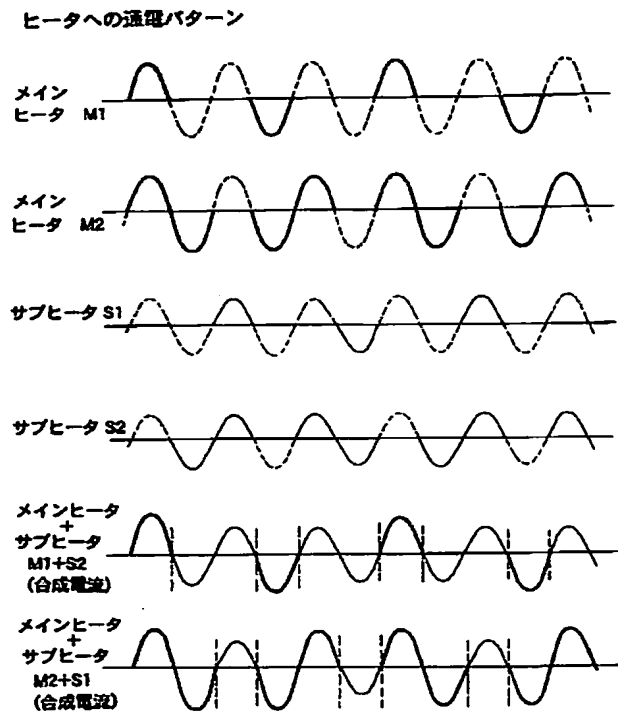
【図8】



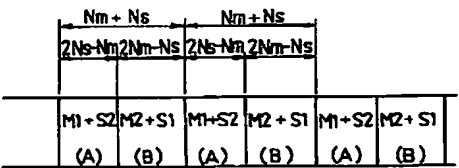
【図6】



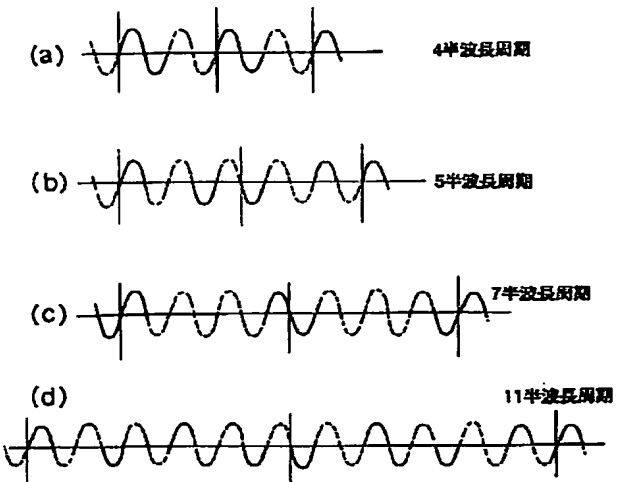
【図7】



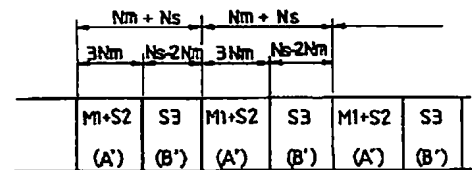
【図9】



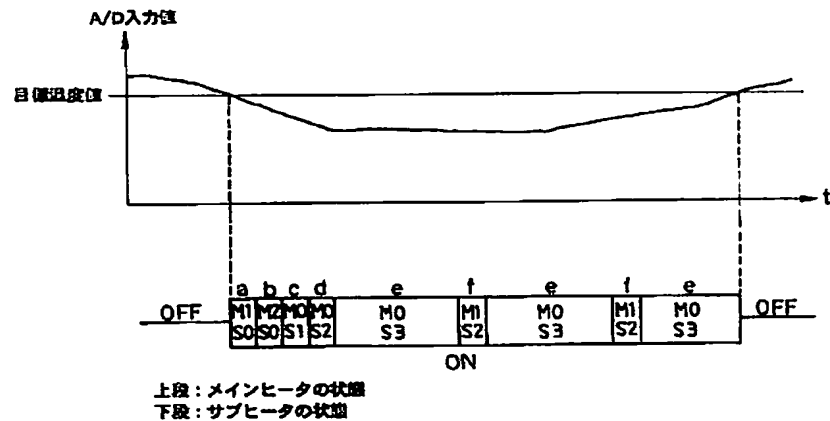
【図15】



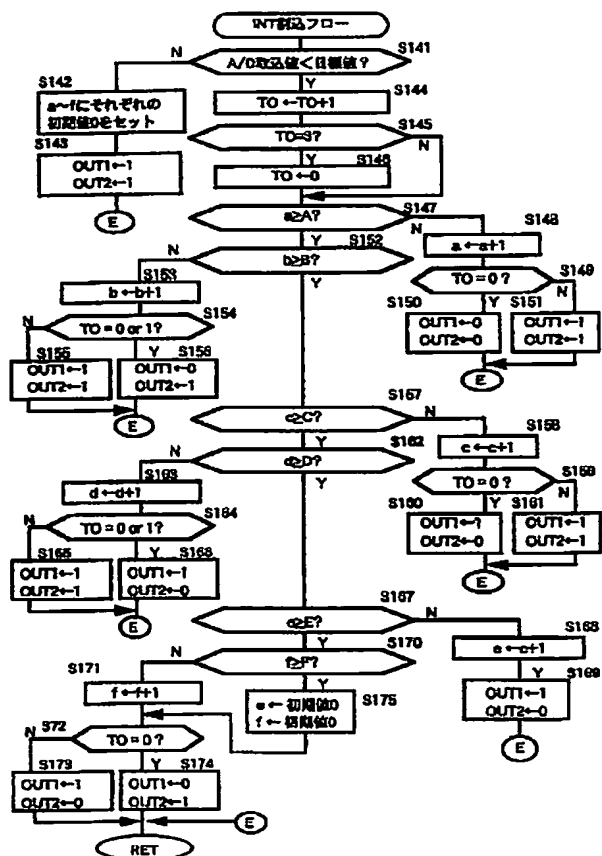
【図10】



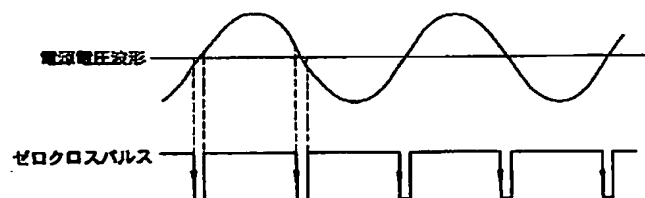
【図12】



【図 14】



【図 13】



【公報種別】特許法第 17 条の 2 の規定による補正の掲載
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【F 1】

G03G 15/20 109

G05F 1/455 B

【手続補正書】

【提出日】平成 12 年 12 月 21 日（2000. 12. 21）

【手続補正 1】

【補正対象書類名】明細書

【補正対象項目名】請求項 9

【補正方法】変更

【補正内容】

【請求項 9】トナー像を用紙上に定着させる定着器を有する画像形成装置であって、前記定着器の定着ヒータとしての第 1 および第 2 のヒータと、該第 1 および第 2 のヒータに対する交流電源電圧の印加をそれぞれ独立に制御する第 1 および第 2 のスイッチング手段と、前記定着ヒータのヒータ温度を検出する温度検出手段と、交流電源電圧のゼロクロス点を検出するゼロクロス検出手段と、前記温度検出手段により検出された温度が予め定められた温度より低下したとき、前記ゼロクロス検出手段によるゼロクロスの度に、順次、予め定められた手順で前記第 1 および第 2 のヒータに対して半波長単位の前記電源電圧の印加の是非を決定し、該決定結果に基づいて前記第 1 および第 2 のスイッチング手段を制御する制御手段とを備えたことを特徴とする画像形成装置。

【手続補正 2】

【補正対象書類名】明細書

【補正対象項目名】0025

【補正方法】変更

【補正内容】

【0025】本発明による画像形成装置は、トナー像を用紙上に定着させる定着器を有する画像形成装置であって、前記定着器の定着ヒータとしての第 1 および第 2 の

ヒータと、該第 1 および第 2 のヒータに対する交流電源電圧の印加をそれぞれ独立に制御する第 1 および第 2 のスイッチング手段と、前記定着ヒータのヒータ温度を検出する温度検出手段と、交流電源電圧のゼロクロス点を検出するゼロクロス検出手段と、前記温度検出手段により検出された温度が予め定められた温度より低下したとき、前記ゼロクロス検出手段によるゼロクロスの度に、順次、予め定められた手順で前記第 1 および第 2 のヒータに対して半波長単位の前記電源電圧の印加の是非を決定し、該決定結果に基づいて前記第 1 および第 2 のスイッチング手段を制御する制御手段とを備えたことを特徴とする。

【手続補正 3】

【補正対象書類名】明細書

【補正対象項目名】0032

【補正方法】変更

【補正内容】

【0032】図 6 に、本発明による「波数制御」の一例を示す。これは、ハロゲンヒータの突入電流部に対して実施される。突入電流部は、ヒータ ON 直後の立ち上がり部であり、平均的に、徐々に電流が増加するようにすればよい。そのために、この例では、メインヒータ ON から開始して、まず期間 a に示した様に 3 半周期に 1 回の半波長分を周期的に通電する（これを「1/3 半波」と呼ぶ）。次に、期間 b に示したように、3 半周期に 2 回の半波長分を周期的に通電する（これを「2/3 半波」と呼ぶ）。続いて、メインヒータを必要な時間だけ全周期分通電してもよい（これを「全周期」と呼ぶ。図示せず）。この後、メインヒータ 4 を消灯し、サブヒータ 5 のみの通電を続けるが、同様に、まず、1/3 半波の期間 c、次に、2/3 半波の期間 d、その後、間引きなしの全周期の期間 e となる。

【手続補正 4】

【補正対象書類名】明細書

【補正対象項目名】0059

【補正方法】変更

【補正内容】

【0059】判断S147で、aカウンタの状態を見て、予め定めた規定値Aに達していなければ、即ち、図12内のa状態であればN側へ処理が流れ、aカウンタを1カウントアップさせる(S148)。ここに、規定値Aは状態aにおける半波の個数である(後述する他の規定値についても同様)。次に判断S149で、前述の間引きカウンタTOの値を確認する。この値が0であれば、メインヒータ4をONし(S150)、それ以外の値1または2であれば、メインヒータ4、サブヒータ5共にOFF状態とする(S151)。

【手続補正5】

【補正対象書類名】明細書

【補正対象項目名】0063

【補正方法】変更

【補正内容】

【0063】次の判断S170では、図12内のf状態であるか否かを判断する。fカウンタがその規定値Fに達しない間、処理はN側に流れ、fカウンタを1カウントアップし(S171)、判断S172で間引きカウンタTOを確認して、その値が0であればメインヒータ4

のみをONし(S174)、それ以外は、サブヒータ5のみをONする(S173)。結果としてメインヒータM1状態と、サブヒータS2状態が合成された形のM1+S2(図7内参照)の通電状態となる。

【手続補正6】

【補正対象書類名】明細書

【補正対象項目名】0064

【補正方法】変更

【補正内容】

【0064】また、このfカウンタが規定値Fに達したときは、判断S170で処理がY側に流れeカウンタおよびfカウンタに初期値0が再セットされる。その結果、次のINT割り込みでは、判断S167のeカウンタの規定値到達が解除されていることになるので、もう一度e状態、即ち、サブヒータ5がON(S3状態)となって、f→e→f→・・・と、この2状態が繰り返されることとなる。

【手続補正7】

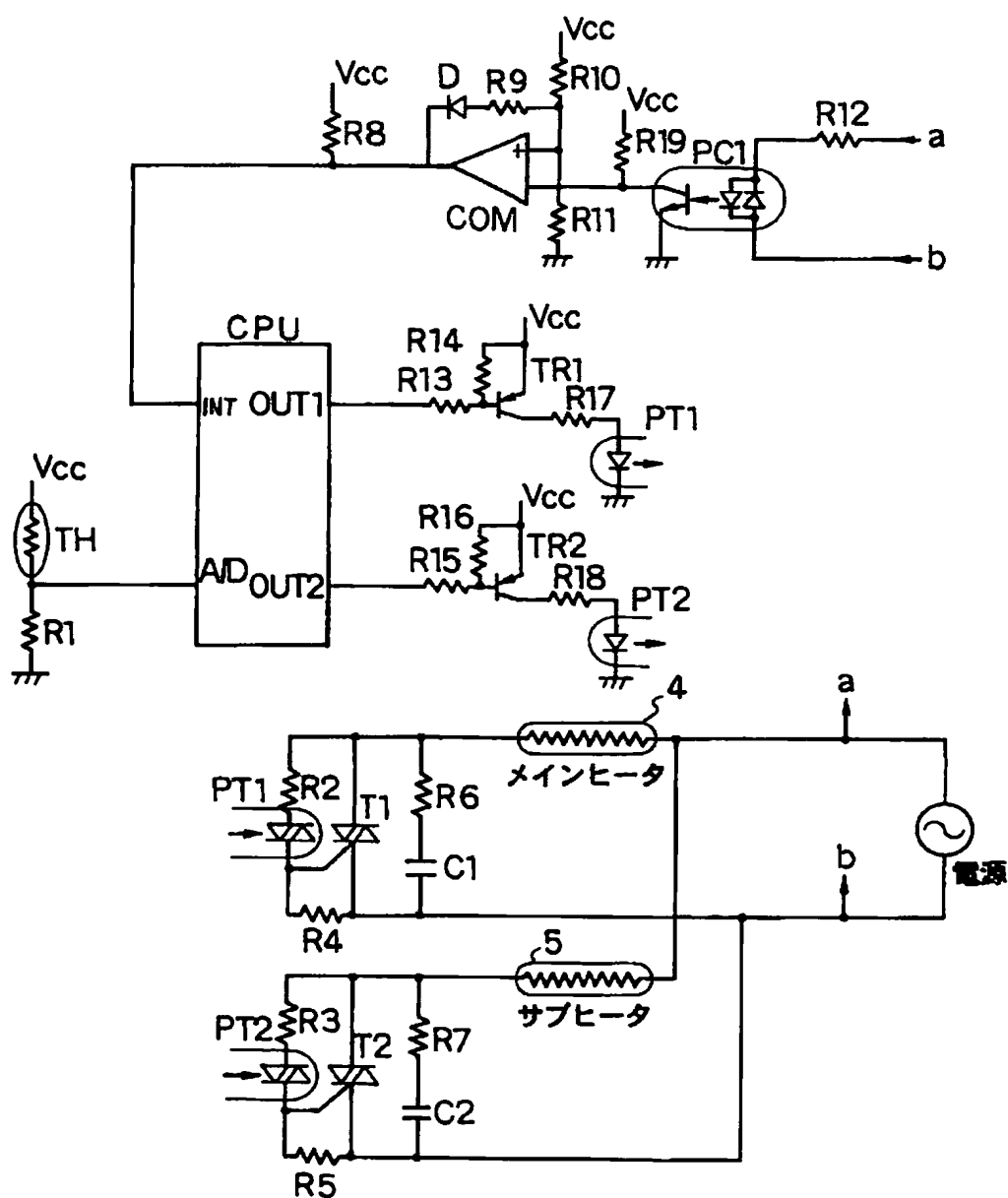
【補正対象書類名】図面

【補正対象項目名】図11

【補正方法】変更

【補正内容】

【図11】



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(43)Date of publication of application : 09.04.1999

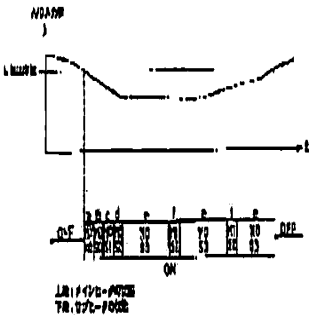
(51)Int.Cl. G03G 15/20
G05F 1/455

(21)Application number : 09-272107 (71)Applicant : COPYER CO LTD
(22)Date of filing : 18.09.1997 (72)Inventor : NISHIDA YOSHIAKI
SUZUKI YASUHIRO

(54) METHOD FOR CONTROLLING FIXING HEATER AND IMAGE FORMING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for controlling a fixing heater and an image forming device adopting the same, capable of reducing a drastic current change caused by the fixing heater, without depending on the phase control.
SOLUTION: Right after the start of applying an AC power source voltage when the heater temp. falls to fellow a target temp., in order to reduce the heater current, by regarding 3 halfwave lengths as a period of the AC power source voltage applied to the fixing heater, the thinning number is decreased from a large number to a small one. When the device is provided with two heaters, the same method is successively applied to each of the heater (states a, b, c and d). Subsequently, application of voltage is performed with the thinning number



0. At this time too, by regarding the successive 3 halfwave lengths as one period, power is applied to a first heater by thinning the waveform of one halfwave length or two halfwave lengths out of 3 halfwave lengths for one period, while the power having the waveform of only halfwave lengths which are used for thinning the first heater is applied to a second heater, which is a state (f) of applying a first energizing pattern. The state (f) and the state (e) of energizing only one of the heaters (or state of reversing the relation between both heaters in the state (f)) are alternately repeated, until the heater temp. reaches the desired temp.

LEGAL STATUS

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[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
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[Patent number] 3316170
[Date of registration] 07.06.2002
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The control approach of the fixing heater characterized by to shift to the wave-like impression without infanticide after adopting the control which thins out 1 of them, or the wave for two or more half-wave lengths and impressing the infanticide wave by said infanticide control to said fixing heater immediately after impression initiation of the AC-power-supply electrical potential difference to said fixing heater by making into a period a part for the 3 half-wave lengths which the AC-power-supply electrical potential difference impressed to a fixing heater follows at least.

[Claim 2] The control approach of the fixing heater which is an approach according to claim 1, performs impression of a term two or more rounds as two infanticide, and shifts to impression with zero infanticide after that by making a part for the 3 half-wave length into a period immediately after impression initiation of said AC-power-supply electrical potential difference.

[Claim 3] The control approach of the fixing heater which is an approach according to claim 1, and is considered as zero infanticide after changing the number of infanticide from size to smallness immediately after impression initiation of said AC-power-supply electrical potential difference.

[Claim 4] The control approach of the fixing heater which it is an approach according to claim 3, and performs impression of a term two or more rounds as two infanticide, subsequently performs impression of a term for the number of infanticide two or more rounds as 1, and shifts to impression with zero infanticide after that by making a part for the 3 half-wave length into a period immediately after impression initiation of said AC-power-supply electrical potential difference.

[Claim 5] It is an approach according to claim 1. Said fixing heater In case it consists of the 1st heater and 2nd heater and energizes by turns to said the 1st heater and 2nd heater, a part for the 3 continuous half-wave lengths is made into a period. The control approach of a fixing heater of thinning out

and energizing the wave for the 1 half-wave length of the 3 half-wave lengths of one period, or the 2 half-wave lengths at the 1st heater, and impressing the wave only for the half-wave length thinned out at the 1st heater to the 2nd heater.

[Claim 6] The control approach of the fixing heater which is an approach according to claim 5 and changes by turns the 1st energization pattern to the 1st and 2nd heaters according to claim 5, and the 2nd energization pattern which made reverse relation of the 1st and 2nd heaters.

[Claim 7] Continuation impression of the half-wave length of Nm individual [as opposed to / are an approach according to claim 6 and / the 1st heater], As control equivalent to the control which repeats continuation impression of the half-wave length of Ns individual to the 2nd heater by turns, a part for the half-wave length of 2 Ns-Nm individual and said 1st energization pattern perform energization to the 1st and 2nd heaters. Subsequently It is the control approach of the fixing heater characterized by repeating performing energization to the 1st and 2nd heaters by said 2nd energization pattern by turns by the half-wave length of 2 Nm-Ns individual.

[Claim 8] The control approach of the fixing heater which is an approach according to claim 5 and changes the 1st energization pattern to the 1st and 2nd heaters according to claim 5, and energization with one zero infanticide of the 1st and 2nd heaters by turns.

[Claim 9] It is image formation equipment which has the fixing assembly which fixes a toner image on a form. The 1st and 2nd heaters as a fixing heater of said fixing assembly, The 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively, this — with 1st and 2nd switching means to control switching of the 1st and 2nd switching means When it falls from the temperature as which the temperature detected by temperature detection means to detect the heater temperature of said fixing heater, zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference, and said temperature detection means was determined beforehand, The procedure defined beforehand determines the right or wrong of impression of said supply voltage of a half-wave length unit at every zero cross by said zero cross detection means to said 1st and 2nd heaters one by one. Image formation equipment characterized by having the control means which controls said 1st and 2nd switching means based on this decision result.

[Claim 10] It is image formation equipment characterized by said the 1st heater and 2nd heater differing in distribution of exoergic reinforcement in image formation equipment according to claim 9.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to image formation equipments, such as an electrostatic copying machine and a printer, and relates to the heater control approach of reducing fluctuation of the current which includes the rush current by ON/OFF of the fixing heater especially.

[0002]

[Description of the Prior Art] Conventionally, the halogen lamp with the comparatively large consumed electric current is used for this kind of fixing heater, and there is generating of the very big rush current at the time of that ON. Especially when temperature of a halogen heater the property top of a halogen heater and own is high, the resistance is large, and resistance becomes small when low. Usually, since a halogen heater is turned on when heater temperature becomes lower than the temperature defined beforehand, the big rush current will flow immediately after lighting.

[0003] A voltage variation explanatory view is shown in drawing 5. Generally, when a supply power source is seen from a power-receptacle side, the comparatively small source impedance (R_s) exists. For this reason, when the consumed electric current I of the device (here copying machine) connected to the power source changes suddenly a lot, fluctuation of supply voltage V occurs and the amount of [ΔI then] rapid source effect can estimate the current change with that rapid magnitude as $\Delta V = R_s \Delta I$. For example, if the luminaire 9 is connected to this plug socket line, rapid voltage variation will serve as CHIRATSUKI of lighting, and will appear.

[0004]

[Problem(s) to be Solved by the Invention] Here, the technical problem of this invention is explained in relation to the configuration of a concrete fixing assembly.

[0005] Drawing 1 is a schematic diagram of a fixing assembly with which this

invention is applied, 1 in this expresses a heater roller and 2 expresses a pressurization roller. Thermal melting arrival of the toner image can be carried out on a form 3 by passing the form 3 with which the toner image was developed between both this roller 1 and 2. In the heater roller 1, it is equipped in the form where the Maine heater 4 and the subheater 5 were illustrated.

[0006] That is, as shown in drawing 2, the exoergic intensity distribution of the Maine heater 4 have a peak near a center (drawing 2 A), and, on the other hand, the subheater 5 has a peak in a both-ends side (drawing 2 B). These two heaters are made to turn on by turns, and the temperature distribution on a roller front face are made to equalize by adjusting the lighting time amount of each heater (drawing 2 C).

[0007] Although drawing 3 shows the energization current wave form of HITAE at the time of standby, P1 is a part with a big current change in this. As mentioned above in drawing 5, this current change produced the voltage variation of the supply power source itself, and has caused evils, such as CHIRATSUKI, such as lighting connected to the same power source. The social request that the voltage variation by current change of such a device will be reduced in recent years has become strong.

[0008] Although this invention offers the approach for reducing the rapid current change by the halogen heater used for the fixing assembly of image formation equipment, it is specifically easing the following rapid current change parts shown in drawing 3.

[0009] 1 The rush current section of a halogen heater (P1 in drawing 3, P2 section)

2 The current variation section when changing a heater by turns by the fixing assembly of 2 heater configurations (P3, P4 in drawing 3)

In order to solve such a trouble, energization of HITAE by phase control as shown in drawing 4 can be considered. What is necessary is just to expand gradually the resistance welding time in 1 half-wave length to rapid voltage variation prevention like [at the time of rush current generating just behind Heater ON] to t_{m1} , t_{m2} , t_{m3} , --, t_{mc} first in the form shown, for example in the energization wave of Maine heater 4 HE in drawing 4, since what is necessary is just to enlarge effectual magnitude of an electrical potential difference gradually. It is similarly referred to as t_{s1} , t_{s2} , t_{s3} , --, t_{sc} about the subheater 5. t_{mc} which is equivalent to the steady state energization phase angle of the Maine heater 4 in this, and t_{sc} of the subheater 5 are constant value.

[0010] Since the energization power of the Maine heater 4 in this case is T_m/T and a subheater is the rate of T_s/T when this value is returned and considered to the change wave in drawing 3, it is possible to adjust t_{mc} and t_{sc} according to this value.

[0011] It is also possible to carry out moderate current change near the fact and an ideal by such configuration. However, the following faults also exist in this approach.

[0012] The complexity on control of that the hardware is complicated and those setup, starting, etc., such as a timer style for deciding 1 and a phase angle (namely, time amount, such as **** tmc and tsc), is also considered to become high similarly.

[0013] To the area (regional difference (50Hz and 60Hz)) where 2 differs from a power line period, another setup must be carried out respectively and the complicatedness on the management to the carving is produced.

[0014] Since energization of HITAE is turned on in the middle in not a zero cross origin but the half-wave length so that clearly even if it sees 3 and drawing 4, the evil of generating of a higher-harmonic current is produced. Generating this higher-harmonic current by the high order wave (several times to dozens times) of a power line period, this does active jamming as other device HE connected through the feeder, and a noise, and causes malfunction and failure. Therefore, in the case of phase control, in order to reduce this power-source higher-harmonic-wave current, correspondence of inserting a mass choke coil is needed separately.

[0015] This invention proposes how this is conquerable in view of such a trouble. That is, this invention is not based on phase control, but the image formation equipment which adopted the control approach of a fixing heater and this which can reduce the rapid current change by the fixing heater is offered.

[0016]

[Means for Solving the Problem] After the control approach of the fixing heater by this invention adopts the control which thins out 1 of them, or the wave for two or more half-wave lengths by making into a period a part for the 3 half-wave lengths which the AC-power-supply electrical potential difference impressed to a fixing heater follows at least and impresses the infanticide wave by said infanticide control to said fixing heater immediately after impression initiation of the AC-power-supply electrical potential difference to said fixing heater, it is characterized by to shift to the wave-like impression without infanticide.

[0017] By this, generating of the rush current immediately after impression initiation of the AC-power-supply electrical potential difference to a fixing heater can be prevented. Moreover, since it is not based on phase control but the heater current is impressed from a zero cross origin, while abolishing most generating of the power-source higher harmonic on power-source Rhine, control hardware can be simplified comparatively.

[0018] By making a part for the 3 half-wave length into a period, immediately after impression initiation of said AC-power-supply electrical potential

difference, impression of a term is performed two or more rounds as two infanticide, and, specifically, it shifts to impression with zero infanticide after that.

[0019] According to other standpoints, after the approach of this invention changes the number of infanticide from size to smallness immediately after impression initiation of said AC-power-supply electrical potential difference, it is considered as zero infanticide.

[0020] For example, by making a part for the 3 half-wave length into a period, immediately after impression initiation of said AC-power-supply electrical potential difference, impression of a term is performed two or more rounds as two infanticide, subsequently, impression of a term is performed two or more rounds as 1, and the number of infanticide is shifted to impression with zero infanticide after that.

[0021] When said fixing heater consists of the 1st heater and 2nd heater, in case it energizes by turns to said the 1st heater and 2nd heater, at the 1st heater, the wave for the 1 half-wave length of the 3 half-wave lengths of one period or the 2 half-wave lengths is thinned out and energized by making a part for the 3 continuous half-wave lengths into a period, and the wave only for the half-wave length thinned out at the 1st heater is impressed to the 2nd heater.

[0022] In this case, the 1st energization pattern to such 1st and 2nd heaters and the 2nd energization pattern which made reverse relation of the 1st and 2nd heaters are changed by turns.

[0023] As control specifically equivalent to the control which repeats continuation impression of the half-wave length of Nm individual to the 1st heater, and continuation impression of the half-wave length of Ns individual to the 2nd heater by turns It repeats a part for the half-wave length of 2 Ns-Nm individual and said 1st energization pattern performing energization to the 1st and 2nd heaters, and performing energization to the 1st and 2nd heaters subsequently by the energization pattern of the account 2nd of a half-wave length quota of 2 Nm-Ns individual by turns.

[0024] How to change the 1st energization pattern to the 1st and 2nd above-mentioned heaters and energization with one zero infanticide of the 1st and 2nd heaters by turns as an option is also considered.

[0025] The image formation equipment by this invention is image formation equipment which has the fixing assembly which fixes a toner image on a form. The 1st and 2nd heaters as a fixing heater of said fixing assembly, The 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively, this -- with 1st and 2nd switching means to control switching of the 1st and 2nd switching means When it falls from the temperature as which the temperature detected by temperature detection

means to detect the heater temperature of said fixing heater, zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference, and said temperature detection means was determined beforehand. The procedure defined beforehand determines the right or wrong of impression of said supply voltage of a half-wave length unit at every zero cross by said zero cross detection means to said 1st and 2nd heaters one by one. It is characterized by having the control means which controls said 1st and 2nd switching means based on this decision result.

[0026] In this image formation equipment, said the 1st heater and 2nd heater differ in distribution of exoergic reinforcement preferably.

[0027]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained to a detail.

[0028] It is as having mentioned above with reference to drawing 1 and drawing 2 about the outline configuration of the fixing assembly to which this invention is applied. That is, the light is made to switch on by turns on the principle of two heaters, the Maine heater 4 as a fixing heater, and the subheater 5, and the temperature distribution on a heater roller front face are made to equalize by adjusting the lighting time amount of each heater.

[0029] Although the energization pattern to both the heaters shown in drawing 3 is not based on this invention, the meaning of using two heaters is briefly explained using this energization pattern.

[0030] At the time of standby without ***, as compared with the subheater 5, energization of the Maine heater 4 is short to the appearance shown in drawing 3, and mutual lighting of both the heaters is carried out. Moreover, it is at the *** time, and in the case of the form of small size, since the latent heat near the center of a heater roller is taken, lighting time amount of the Maine heater 4 is lengthened. thus, the time of standby — every modes at the time of a copy etc. — mutual lighting time amount — changing — the heat distribution on a heater roller — homogeneity — carrying out — making — especially — the case of small size ***** — a part for the non-paper-feed-section on a heater roller — that is, (part near both sides), an unnecessary temperature up is prevented and damage by the fault temperature up of the bearing of a heater roller edge or a drive gear part is prevented.

[0031] With the gestalt of this operation, it is going to obtain a result equivalent to exoergic control of such two heaters, inhibiting rapid fluctuation of an average current.

[0032] An example of "wave number control" by this invention is shown in drawing 6. This is carried out to the rush current section of a halogen heater. It is the standup section just behind Heater ON, on the average, the rush current section is worn so that a current may increase gradually, and its

** is good. Therefore, in this example, it starts from the Maine heater ON and a part for 1 time of the half-wave length is periodically energized to the appearance shown first at Period a at three half periods (this is called "1/3 half wave"). Next, as shown at Period b, a part for 2 times of the half-wave lengths is energized periodically at three half periods (this is called "2/3 half wave"). Then, only required time amount may energize the Maine heater by the perimeter term (this is called a "perimeter term"). It does not illustrate. Then, although the Maine heater 4 is switched off and energization of only the subheater 5 is continued, the period e of a perimeter term without infanticide comes first similarly the period c of 1/3 half wave next the period d of 2/3 half wave, and after that.

[0033] namely, this — starting — the time — an average current — being gradual (here three-stage) — I hear that it changes and goes in the direction which becomes large one by one from the smaller one, and is finally made to shift to a perimeter term, and it is. In other words, in order that it thins out by the 2 half-wave length among 3 half-wave-length periods since there is most rush current (Period a or Period c), and it may be the place whose heater wires got warm for a while after that and the rush current may also decrease, it thins out by 1 half-wave length among 3 half-wave-length periods at the beginning of starting (Period b or Period d). And finally it will be said that it changes to the perimeter term impression with zero infanticide.

[0034] Here, a reason with desirable performing wave number infanticide on the basis of 3 half-wave length periods is explained. For example, if it sees on the basis of the 2 half-wave lengths (one usual period), and it will thin out by the 1 half-wave length from now on, it will become the same dc component as a half-wave rectification wave. Now it becomes direct-current lighting and such a drive is not recommended in a halogen heater. Moreover, infanticide with a period longer than 3 half-wave length periods becomes sensitive as CHIRATSUKI on the character called CHIRATSUKI, such as lighting, at the eyes of the infanticide actuation itself and a man. Therefore, thinking, the shortest periods, i.e., 3 half-wave length periods, other than 2 half-wave lengths, will say that it is the most appropriate. In fact, in infanticide of this 3 half-wave-length period, when lighting was actually connected and CHIRATSUKI was observed, most feeling of CHIRATSUKI was not sensed experimental.

[0035] However, since effectiveness is conventionally accepted also by infanticide with a period longer than 3 half-wave length periods, this invention does not eliminate this so that it may mention later.

[0036] Next, the mitigation approach of current change (P3 in drawing 3, P4 section) produced at the time of two halogen heater changes, i.e., the change on another side from one side of the Maine heater 4 and the subheater 5, is

described.

[0037] Conventionally, the periodic change of 2 heaters was performed to the appearance shown in drawing 3 the comparatively big period (hundreds mSec(s) – number Sec extent) so that other one side might be told to one degree. This invention performs this change by the view of making it even a limit early.

[0038] The approach of changing in the gestalt of this operation is shown in drawing 7. First, as shown in a condition M1, half-wave length energization of the Maine heater 4 is carried out, and the 2 half-wave lengths following it repeat control of energizing only the sub heater 5 as shown in a condition S2. The current variation by two heater changes serves as a form finely decomposed for every 3 half-wave length periods as the synthetic current carried out in this way is shown in condition M1+S2. Since it is generated in a minute time interval, the line voltage variation by fluctuation of 3 half-wave length periods is not sensed as CHIRATSUKI, such as lighting, as a matter of fact. If actually adapted in such a view, the change of two heaters conventionally it was shown in drawing 8, if the subheater 5 was carrying out to the Maine heater 4 by the repeat of continuous half wave (S3) impression of Ns individual after continuous half wave (M3) impression of Nm individual like The heater change for every 3 half-wave length periods of this and equivalence It becomes the pattern which was shown in drawing 9 and which compounds energization (S2 in drawing 7 condition) like by the 2 half-wave lengths in 1 half-wave-length energization in 3 half-wave lengths of the Maine heater 4 (M1 in drawing 7 condition), and 3 half-wave lengths of a subheater, i.e., the energization pattern shown in M1+S2 condition of drawing 7. This energization pattern is a part for the half-wave length of 2 Ns-Nm individual (A section in drawing 9 > it continues).

[0039] Next, the pattern which compounds 2 half-wave-length energization (M2 in drawing 7 R> 7 condition) of the Maine heater 4 and 1 half-wave-length energization (S1 condition in drawing 7) of the subheater 5, i.e., the energization pattern shown in M2+S1 condition of drawing 7, performs half-wave length part impression (the B section in drawing 9) of 2 Nm-Ns individual. Such a repeat of the inside A of drawing 9 and the B section is equivalent to the conventional change pattern (drawing 8 R> 8). A repeat period when the reason puts the inside A and B of (1) drawing 9 at one period is a part for the half-wave length of a Nm+Ns individual, and be conventionally the same as the case of a pattern (drawing 8).

[0040] (2) It of Nm and the subheater 5 is Ns, and that of the number of all the impression half waves of the Maine heater 4 of the inside A of drawing 9 and B circles conventionally the same as that of the number of energization half waves in 1 period of a pattern.

[0041] Conventionally, as compared with impression of a pattern, the calorific

value of each heater is clearly more nearly equal than (3), (1), and (2), if it sees the whole period.

[0042] Furthermore, although it already said that an idea is advanced and the fluctuation in 3 half-wave length periods in [A] drawing 9 and inside B does not become a problem, the average current difference of the A section in the said drawing and the B section becomes a problem. However, if this amount is evaluated, the average current of A circles will serve as $I_m(1/3)+(2/3) I_s$, and the average current of B circles will serve as $I_m(2/3)+(1/3) I_s$. Therefore, the difference of Both A and B part is $((1/3) I_m+(2/3) I_s)-(2/3) (I_m+(1/3) I_s) = (1/3) (I_s-I_m)$.

It turns out that it is one third a next door and in conventional. (The stationary current value when impressing I_m here a Maine heater 4 HE perimeter term and I_s are taken as it of subHITAHE.) The time of being 2 $N_m \leq N_s$ is considered by the above-mentioned case of being special. In this case, the number of half waves of the B section of drawing 9 becomes negative. Then, as shown in drawing 10, the 3Nm half-wave length part subheater 5 is made S2 condition impression, and the Maine heater 4 adds the wave made M1 condition impression, and impresses S tri-state of only the subheater 5 by the half wave (N_s-2N_m) after that. Even if it considers this case, a repeat period is $T=N_m+N_s$ (number of a half wave), and it by which the number of half waves impressed to the Maine heater 4 in that period T is impressed to Nm and a subheater is Ns, and is not different from the time of the conventional change. furthermore, A in drawing 10 and B' — the average current difference between the sections — $((1/3) I_m+(2/3) I_s)-I_s = (1/3) (I_m-I_s)$

It turns out that it becomes and has become one third in conventional (drawing 8).

[0043] What is necessary is just to think the same way in 2 $N_s \leq N_m$. That is, although not illustrated, A' section in drawing 10 is considered to be S1+M2 condition, and B' section is considered to be M tri-state. Moreover, the number of half waves of A' section at this time is set to 3Ns(es), and the number of half waves of B' section is set to N_m-2N_s . A' in this case, and B' — the difference of the average current between the sections — $((1/3) I_s+(2/3) I_m)-I_m = -(1/3) (I_m-I_s)$

Although a next door and a sign are reversed, it turns out too that the absolute value of a current difference is one third in conventional.

[0044] At saying that it rises from the condition that the average current is low, by thinning out a wave in the period of the 3 half-wave length with the gestalt of this operation in short at the time of heater starting, and the time of a heater change Within the period of three half waves, if the Maine heater 4 and the subheater 5 are switched at a rate of one half wave and two half waves (1 period) following it The source-effect frequency caused by the

current difference between both heaters becomes high, and it can be said that CHIRATSUKI, such as lighting connected to the power source, uses as a result what no longer sensing for people's eyes.

[0045] Drawing 11 is a circuit diagram for realizing "wave number control" mentioned above.

[0046] The inside of this drawing and TH are temperature sensors (it is 6in drawing 1), and this is connected to resistance R1 and that partial pressure potential is inputted into analog input terminal A/D in CPU, such as a thermistor which detects the temperature of a heater roller (1 in drawing 1). Analog-to-digital conversion of the signal given to the A/D terminal is carried out, and it is processed within CPU. The zero cross pulse (refer to drawing 13) corresponding to the zero crossing point of an AC-power-supply electrical potential difference is inputted into the INT input terminal of CPU. This zero cross pulse is generated by a photo coupler PC 1 and Comparator COM based on the alternating-voltage input of a power source.

[0047] According to falling of a zero cross pulse, the interruption routine inside CPU (after-mentioned) is started, and the signals OUT1 and OUT2 which make the Maine heater 4 and the subheater 5 turn on to predetermined timing immediately after this zero cross signal falling, respectively are outputted.

[0048] For example, when OUT1 output is H level, the transistor TR1 was set to OFF and the luminescence side of phot triac PT1 has gone out. Since a phot triac is also OFF the light-receiving side of PT1 and the gate current of a triac T1 does not flow, a triac T1 will be in an OFF condition, and the Maine heater 4 will be switched off. In addition, in the gestalt of this operation, a transistor TR1, phot triac PT1, and a triac T1 constitute a "switching means."

[0049] On the contrary, when OUT1 is L level, actuation contrary to **** is carried out, a transistor TR1 turns on the light emitting diode of ON and phot triac PT1, and a phot triac turns it on a light-receiving side. Since the light-receiving side of PT1 flows, the gate current the ** style was carried out [gate current] by resistance R2 or R4 is supplied to the gate of a triac T1. Therefore, a triac T1 is flowed through it and turns on the Maine heater 4.

[0050] Connection of the resistance R6 and the capacitor C1 which were connected to juxtaposition at the triac T1 is the so-called snubber circuit, and when there is an abrupt change of supply voltage under the effect of an outpatient department noise etc., it is for preventing that a triac T1 turns on independently (the same is said of resistance R7 and a capacitor C2).

[0051] The flow of OUT2 output which controls lighting of the subheater 5 is the same as the above.

[0052] In the above, the example of the control performed by the explained circuit is explained. Here, although two energization patterns at the time of the change of the Maine heater 4 and the subheater 5 were made into condition A' of drawing 10, and the thing corresponding to B', according to the object to apply, it can consider as the combination of another energization pattern as shown in drawing 9.

[0053] Like, when the signal corresponding to the CPUA/D input value in drawing 11, i.e., the temperature of the heater roller 1, shown in drawing 12 has exceeded from target temperature, both the Maine heater 4 and the subheater 5 are OFF (when roller temperature is high). Moreover, like, when less, heater lighting control is carried out in the form which was shown in drawing 12 and which repeats condition a->b->c->d->e to f->e->f->e until roller temperature exceeds a target temperature value. The condition a of these is in M1 energization (1 half-wave length ON in 3 half-wave lengths) condition of the Maine heater 4 shown in drawing 7 like mentioned above, and the subheater 5 is OFF. The Maine heaters 4 are [M2 energization (S2 wave in drawing 7) and the subheater 5 of Condition b] OFF. Conditions c are the Maine heater OFF and the subheater five S1. The Maine heaters 4 of Condition d are OFF and the subheater five S2.

[0054] Thus, current change of each heater to the rush current is made to ease in the Condition a, b, c, and d. Since it is the same as the contents shown in drawing 8 about this, it is as having already explained. Speaking of the repeat of the conditions e and f after it, the Maine heater 4 of Condition e is OFF, and the subheater 5 is the perimeter term ON (S3). The Maine heater 4 of Condition f is synthetic energization of the subheater five S2 in M1 energization. This pattern is as it having been the same as that of the pattern shown in drawing 7, and having also already explained this. In short, this is actuation for reducing change current change produced at the time of the change of the Maine heater 4 and the subheater 5.

[0055] The flow chart with which an example of the software procedure for realizing above-mentioned control is expressed to drawing 14 is shown.

[0056] It already described that the zero cross pulse shown in drawing 13 is given to the interruption input INT to CPU (drawing 11). By falling of this zero cross pulse, interruption actuation starts the processing in CPU and the procedure shown in the flow of drawing 14 is performed.

[0057] First, when an A/D input value is higher than target temperature, processing flows to the N side by decision S141, and each initial value 0 is set to Counters a, b, c, d, e, and f (S142). Moreover, 1 is respectively set to OUT1 and OUT2 (S143), and both the Maine heater 4 and the subheater 5 are turned off by this. Counters a, b, c, d, e, and f are counters which determine each duration of the conditions a, b, c, d, e, and f at the time of the heater ON shown in drawing 12, and they are managed with the number

of zero cross pulses, i.e., the number of power-source half waves.

[0058] As mentioned above, although processing when roller temperature is higher than a target was described, if the value (temperature is low) than which the A/D input value was less from target temperature is shown, whenever interruption starts, it will judge within [S141] a flow, and processing will flow to the Y side shortly. At the time, I is added to the infanticide counter TO (S144). Whenever this infanticide counter TO passes this part of a flow by 0->1->2->0->1->2 and interruption, a condition continues the round of the condition of three one progress. When a counter value is set to 3, he is trying to return to initial value 0 by decision S145 (S146). This counter TO is processed [subsequent] and the duty of the directions pointer of of which location in 3 half-wave lengths to point out the half-wave length is achieved.

[0059] By decision S147, the condition of a counter is seen, if the default value A defined beforehand is not reached, namely, if it is in a condition in drawing 1212, processing will flow to the N side and 1 ***** of a counters will be carried out (S138). Default value A is the number of a half wave [in / here / Condition a] (the same about other default value mentioned later). Next, by decision S149, the value of the above-mentioned infanticide counter TO is checked. If this value is 0, the Maine heater 4 is turned on (S150), and if it is the other values 1 or 2, the Maine heater 4 and the subheater 5 will be made into an OFF condition (S151).

[0060] It is at the time when heater temperature is lower than target temperature, and if the infanticide counter TO goes round (0->1->2->0-> ...) and a counter has not reached the default value A, the decision section S149 will be passed each time, and the Maine heater 4 will be periodically turned on by 1 half wave in three half waves at each time when falling of a zero cross pulse starts an INT input. In the decision section S149, it can be said that the energization condition M1 shown in drawing 7 is made. If a counter reaches default value A, it will end the condition a which showed in drawing 12, and will shift to Condition b. Namely, if the condition of b counter is checked within [S152] a flow and the default value B is not reached, processing flows to the N side, I count-up of b counter is done (S153), it thins out in decision S154, and the value of Counter TO turns on the Maine heater 4 only at the time of 0 or 1 (S155, S156). This can be said to be having realized the energization condition M2 shown in drawing 7.

[0061] as mentioned above, if it comes out so and is, c counter will be counted up one time by decision S158, it sees whether in the decision section S157, it is in c condition in drawing 12 similarly, the infanticide counter TO is seen (S159), when the infanticide counter TO is 0, only the sub heater 5 is turned on and S1 condition (inside of drawing 7) is realized (S160, S161). And in the following decision S162, d condition is judged and

only five is made into subheater 2 condition by decision S164 after 1 count-up (S163) of d counter (S165, S166). Furthermore, in the following decision S167, e condition is judged and let only the subheater 5 be S tri-state after 1 count-up (S168) of e counter (S169).

[0062] Above, a, b, c and d in drawing 12, and e condition are completed. That is, it means ending a series of standup section sequences shown in drawing 6.

[0063] In the following decision S170, it judges whether it is in f condition in drawing 12. While f counter does not reach the default value F, processing flows to the N side, counts up f counter one time (S171), is thinned out in decision S172, checks Counter TO, if the value is 0, turns on only the Maine heater 4 (S174), and turns on only the subheater 5 except it (S173). It will be in a Maine heater M1 condition and the energization condition of refer to [of the form where subheater S2 condition was compounded] the inside of M1+S2< drawing 7 as a result.

[0064] Moreover, when this f counter reaches default value F, processing flows to the Y side by decision S170, and initial value 0 is re-set to e counter and f counter. consequently — since default value attainment of e counter of decision S167 will be canceled in the next INT interruption — once again — the e condition 5, i.e., a subheater, — ON (S tri-state) — becoming — f->e->f-> ... and these 2 conditions will be repeated.

[0065] Thus, it was shown that the lighting condition of the heater shown in drawing 12 is realizable.

[0066] In addition, after an a-f counter sets up those default value A, B, C, D, E, and F as initial value unlike the above, you may make it investigate whether each counter value amounted to 0 by carrying out the subtrahend.

[0067] According to the gestalt of the above operation, the following exceptional effectiveness is acquired.

[0068] (1) Control hardware becomes comparatively simple. For example, as a means to control the heater current, although a phase control method is generally held like, it is necessary to generate the pulse which specifies the phase angle (time amount in a time interval sufficiently shorter than the time amount of the half-wave length) which was mentioned above, and which should set up a timer from the zero crossing point of supply voltage in this case, and should turn on a heater. These have the fault that hardware, such as the complexity of the control [itself] and a timer style, must be prepared. If it is "wave number control" like this invention, since it is only turning on a heater on a zero cross origin, the timer which determines a phase becomes unnecessary. Moreover, the complexity on control, such as those setup and starting, decreases that much.

[0069] (2) Since the heater current is impressed from a zero cross origin in "wave number control", I hear that other advantages when comparing with

phase control do not almost have the current change of a frequency with the high order power line period on power-source Rhine, and generating of the so-called power-source higher harmonic, and there are. Usually, although it was necessary for the heater and the serial to insert a mass inductance (choke coil) in order to press down generating of such a power-source higher harmonic wave, this had become the cause in which invites the cost rise by addition of an excessive electrical part, and the request of reservation of the installation bars miniaturization of a machine.

[0070] Above, although the example of a type about "wave number control" of this invention was shown, deformation of the following forms is also considered.

[0071] The example for easing the rush current was shown in drawing 6. for example, ***** referred to as reducing the magnitude of current variation too even if there are no conditions b and d in this and it is the shift from 1/3 half wave to a perimeter term wave -- it has fixed effectiveness. Similarly, there are no conditions a or c and, only also in Conditions b or d, the same thing can be said.

[0072] This invention contains ** in all the combination that can reduce an average current value by thinning out by the 1 or 2 half-wave lengths, and can reduce the magnitude of the rush current out of the period of 3 half-wave length units in short at the time of this starting just.

[0073] Although the example in mutual lighting of the Maine heater 4 and the subheater 5 and the so-called flicker ring lighting was shown in drawing 9

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TECHNICAL FIELD

[Field of the Invention] This invention relates to image formation equipments, such as an electrostatic copying machine and a printer, and relates to the heater control approach of reducing fluctuation of the current which includes the rush current by ON/OFF of the fixing heater especially.

[Translation done.]

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 PRIOR ART

[Description of the Prior Art] Conventionally, the halogen lamp with the comparatively large consumed electric current is used for this kind of fixing heater, and there is generating of the very big rush current at the time of that ON. Especially when temperature of a halogen heater the property top of a halogen heater and own is high, the resistance is large, and resistance becomes small when low. Usually, since a halogen heater is turned on when heater temperature becomes lower than the temperature defined beforehand, the big rush current will flow immediately after lighting.

[0003] A voltage variation explanatory view is shown in drawing 5. Generally, when a supply power source is seen from a power-receptacle side, the comparatively small source impedance (R_s) 7 exists. For this reason, when the consumed electric current I of the device (here copying machine) connected to the power source changes suddenly a lot, fluctuation of supply voltage V occurs and the amount of [ΔI then] rapid source effect can estimate the current change with that rapid magnitude as $\Delta V = R_s \Delta I$. For example, if the luminaire 9 is connected to this plug socket line, rapid voltage variation will serve as CHIRATSUKI of lighting, and will appear.

 [Translation done.]

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 EFFECT OF THE INVENTION

[Effect of the Invention] Since according to this invention it cannot be based on phase control but the rapid current change by the halogen heater can be reduced, control hardware can be simplified comparatively. Moreover, since the heater current is impressed from a zero cross origin, most generating of the power-source higher harmonic on power-source Rhine can be abolished.

 [Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Here, the technical problem of this invention is explained in relation to the configuration of a concrete fixing assembly.

[0005] Drawing 1 is a schematic diagram of a fixing assembly with which this invention is applied, 1 in this expresses a heater roller and 2 expresses a pressurization roller. Thermal melting arrival of the toner image can be carried out on a form 3 by passing the form 3 with which the toner image was developed between both this roller 1 and 2. In the heater roller 1, it is equipped in the form where the Maine heater 4 and the subheater 5 were illustrated.

[0006] That is, as shown in drawing 2, the exoergic intensity distribution of the Maine heater 4 have a peak near a center (drawing 2 A), and, on the other hand, the subheater 5 has a peak in a both-ends side (drawing 2 B). These two heaters are made to turn on by turns, and the temperature distribution on a roller front face are made to equalize by adjusting the lighting time amount of each heater (drawing 2 C).

[0007] Although drawing 3 shows the energization current wave form of HITAE at the time of standby, P1 is a part with a big current change in this. As mentioned above in drawing 5, this current change produced the voltage variation of the supply power source itself, and has caused evils, such as CHIRATSUKI, such as lighting connected to the same power source. The social request that the voltage variation by current change of such a device will be reduced in recent years has become strong.

[0008] Although this invention offers the approach for reducing the rapid current change by the halogen heater used for the fixing assembly of image formation equipment, it is specifically easing the following rapid current change parts shown in drawing 3.

[0009] 1 The rush current section of a halogen heater (P1 in drawing 3, P2 section)

2 The current variation section when changing a heater by turns by the fixing assembly of 2 heater configurations (P3, P4 in drawing 3)

In order to solve such a trouble, energization of HITAE by phase control as shown in drawing 4 can be considered. What is necessary is just to expand gradually the resistance welding time in 1 half-wave length to rapid voltage variation prevention like [at the time of rush current generating just behind Heater ON] to t_{m1} , t_{m2} , t_{m3} , ..., t_{mc} first in the form shown, for example in the energization wave of Maine heater 4 HE in drawing 4, since what is necessary is just to enlarge effectual magnitude of an electrical potential difference gradually. It is similarly referred to as t_{s1} , t_{s2} , t_{s3} , ..., t_{sc} about the subheater 5. t_{mc} which is equivalent to the steady state energization phase angle of the Maine heater 4 in this, and t_{sc} of the subheater 5 are constant value.

[0010] Since the energization power of the Maine heater 4 in this case is T_m/T and a subheater is the rate of T_s/T when this value is returned and considered to the change wave in drawing 3, it is possible to adjust t_{mc} and t_{sc} according to this value.

[0011] It is also possible to carry out moderate current change near the fact and an ideal by such configuration. However, the following faults also exist in this approach.

[0012] The complexity on control of that the hardware is complicated and those setup, starting, etc., such as a timer style for deciding 1 and a phase angle (namely, time amount, such as *** t_{mc} and t_{sc}), is also considered to become high similarly.

[0013] To the area (regional difference (50Hz and 60Hz)) where 2 differs from a power line period, another setup must be carried out respectively and the complicatedness on the management to the carving is produced.

[0014] Since energization of HITAE is turned on in the middle in not a zero cross origin but the half-wave length so that clearly even if it sees 3 and drawing 4, the evil of generating of a higher-harmonic current is produced. Generating this higher-harmonic current by the high order wave (several times to dozens times) of a power line period, this does active jamming as other device HE connected through the feeder, and a noise, and causes malfunction and failure. Therefore, in the case of phase control, in order to reduce this power-source higher-harmonic-wave current, correspondence of inserting a mass choke coil is needed separately.

[0015] This invention proposes how this is conquerable in view of such a trouble. That is, this invention is not based on phase control, but the image formation equipment which adopted the control approach of a fixing heater and this which can reduce the rapid current change by the fixing heater is offered.

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MEANS

[Means for Solving the Problem] After the control approach of the fixing heater by this invention adopts the control which thins out 1 of them, or the wave for two or more half-wave lengths by making into a period a part for the 3 half-wave lengths which the AC-power-supply electrical potential difference impressed to a fixing heater follows at least and impresses the infanticide wave by said infanticide control to said fixing heater immediately after impression initiation of the AC-power-supply electrical potential difference to said fixing heater, it is characterized by to shift to the wave-like impression without infanticide.

[0017] By this, generating of the rush current immediately after impression initiation of the AC-power-supply electrical potential difference to a fixing heater can be prevented. Moreover, since it is not based on phase control but the heater current is impressed from a zero cross origin, while abolishing most generating of the power-source higher harmonic on power-source Rhine, control hardware can be simplified comparatively.

[0018] By making a part for the 3 half-wave length into a period, immediately after impression initiation of said AC-power-supply electrical potential difference, impression of a term is performed two or more rounds as two infanticide, and, specifically, it shifts to impression with zero infanticide after that.

[0019] According to other standpoints, after the approach of this invention changes the number of infanticide from size to smallness immediately after impression initiation of said AC-power-supply electrical potential difference, it is considered as zero infanticide.

[0020] For example, by making a part for the 3 half-wave length into a period, immediately after impression initiation of said AC-power-supply electrical potential difference, impression of a term is performed two or more rounds as two infanticide, subsequently, impression of a term is performed two or more rounds as 1, and the number of infanticide is shifted to

impression with zero infanticide after that.

[0021] When said fixing heater consists of the 1st heater and 2nd heater, in case it energizes by turns to said the 1st heater and 2nd heater, at the 1st heater, the wave for the 1 half-wave length of the 3 half-wave lengths of one period or the 2 half-wave lengths is thinned out and energized by making a part for the 3 continuous half-wave lengths into a period, and the wave only for the half-wave length thinned out at the 1st heater is impressed to the 2nd heater.

[0022] In this case, the 1st energization pattern to such 1st and 2nd heaters and the 2nd energization pattern which made reverse relation of the 1st and 2nd heaters are changed by turns.

[0023] As control specifically equivalent to the control which repeats continuation impression of the half-wave length of Nm individual to the 1st heater, and continuation impression of the half-wave length of Ns individual to the 2nd heater by turns It repeats a part for the half-wave length of 2 Ns-Nm individual and said 1st energization pattern performing energization to the 1st and 2nd heaters, and performing energization to the 1st and 2nd heaters subsequently by the energization pattern of the account 2nd of a half-wave length quota of 2 Nm-Ns individual by turns.

[0024] How to change the 1st energization pattern to the 1st and 2nd above-mentioned heaters and energization with one zero infanticide of the 1st and 2nd heaters by turns as an option is also considered.

[0025] The image formation equipment by this invention is image formation equipment which has the fixing assembly which fixes a toner image on a form. The 1st and 2nd heaters as a fixing heater of said fixing assembly, The 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively, this — with 1st and 2nd switching means to control switching of the 1st and 2nd switching means When it falls from the temperature as which the temperature detected by temperature detection means to detect the heater temperature of said fixing heater, zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference, and said temperature detection means was determined beforehand, The procedure defined beforehand determines the right or wrong of impression of said supply voltage of a half-wave length unit at every zero cross by said zero cross detection means to said 1st and 2nd heaters one by one. It is characterized by having the control means which controls said 1st and 2nd switching means based on this decision result.

[0026] In this image formation equipment, said the 1st heater and 2nd heater differ in distribution of exoergic reinforcement preferably.

[0027]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of

this invention is explained to a detail.

[0028] It is as having mentioned above with reference to drawing 1 and drawing 2 about the outline configuration of the fixing assembly to which this invention is applied. That is, the light is made to switch on by turns on the principle of two heaters, the Maine heater 4 as a fixing heater, and the subheater 5, and the temperature distribution on a heater roller front face are made to equalize by adjusting the lighting time amount of each heater.

[0029] Although the energization pattern to both the heaters shown in drawing 3 is not based on this invention, the meaning of using two heaters is briefly explained using this energization pattern.

[0030] At the time of standby without ***, as compared with the subheater 5, energization of the Maine heater 4 is short to the appearance shown in drawing 3, and mutual lighting of both the heaters is carried out. Moreover, it is at the *** time, and in the case of the form of small size, since the latent heat near the center of a heater roller is taken, lighting time amount of the Maine heater 4 is lengthened. thus, the time of standby — every modes at the time of a copy etc. — mutual lighting time amount — changing — the heat distribution on a heater roller — homogeneity — carrying out — making — especially — the case of small size ***** — a part for the non-paper-feed-section on a heater roller — that is, (part near both sides), an unnecessary temperature up is prevented and damage by the fault temperature up of the bearing of a heater roller edge or a drive gear part is prevented.

[0031] With the gestalt of this operation, it is going to obtain a result equivalent to exoergic control of such two heaters, inhibiting rapid fluctuation of an average current.

[0032] An example of "wave number control" by this invention is shown in drawing 6. This is carried out to the rush current section of a halogen heater. It is the standup section just behind Heater ON, on the average, the rush current section is worn so that a current may increase gradually, and its ** is good. Therefore, in this example, it starts from the Maine heater ON and a part for 1 time of the half-wave length is periodically energized to the appearance shown first at Period a at three half periods (this is called "1/3 half wave"). Next, as shown at Period b, a part for 2 times of the half-wave lengths is energized periodically at three half periods (this is called "2/3 half wave"). Then, only required time amount may energize the Maine heater by the perimeter term (this is called a "perimeter term"). It does not illustrate. Then, although the Maine heater 4 is switched off and energization of only the subheater 5 is continued, the period e of a perimeter term without infanticide comes first similarly the period c of 1/3 half wave next the period d of 2/3 half wave, and after that.

[0033] namely, this — starting — the time — an average current — being

gradual (here three-stage) — I hear that it changes and goes in the direction which becomes large one by one from the smaller one, and is finally made to shift to a perimeter term, and it is. In other words, in order that it thins out by the 2 half-wave length among 3 half-wave-length periods since there is most rush current (Period a or Period c), and it may be the place whose heater wires got warm for a while after that and the rush current may also decrease, it thins out by 1 half-wave length among 3 half-wave-length periods at the beginning of starting (Period b or Period d). And finally it will be said that it changes to the perimeter term impression with zero infanticide.

[0034] Here, a reason with desirable performing wave number infanticide on the basis of 3 half-wave length periods is explained. For example, if it sees on the basis of the 2 half-wave lengths (one usual period), and it will thin out by the 1 half-wave length from now on, it will become the same dc component as a half-wave rectification wave. Now it becomes direct-current lighting and such a drive is not recommended in a halogen heater. Moreover, infanticide with a period longer than 3 half-wave length periods becomes sensitive as CHIRATSUKI on the character called CHIRATSUKI, such as lighting, at the eyes of the infanticide actuation itself and a man. Therefore, thinking, the shortest periods, i.e., 3 half-wave length periods, other than 2 half-wave lengths, will say that it is the most appropriate. In fact, in infanticide of this 3 half-wave-length period, when lighting was actually connected and CHIRATSUKI was observed, most feeling of CHIRATSUKI was not sensed experimental.

[0035] However, since effectiveness is conventionally accepted also by infanticide with a period longer than 3 half-wave length periods, this invention does not eliminate this so that it may mention later.

[0036] Next, the mitigation approach of current change (P3 in drawing 3, P4 section) produced at the time of two halogen heater changes, i.e., the change on another side from one side of the Maine heater 4 and the subheater 5, is described.

[0037] Conventionally, the periodic change of 2 heaters was performed to the appearance shown in drawing 3 the comparatively big period (hundreds mSec(s) - number Sec extent) so that other one side might be told to one degree. This invention performs this change by the view of making it even a limit early.

[0038] The approach of changing in the gestalt of this operation is shown in drawing 7. First, as shown in a condition M1, half-wave length energization of the Maine heater 4 is carried out, and the 2 half-wave lengths following it repeat control of energizing only the sub heater 5 as shown in a condition S2. The current variation by two heater changes serves as a form finely decomposed for every 3 half-wave length periods as the synthetic current

carried out in this way is shown in condition M1+S2. Since it is generated in a minute time interval, the line voltage variation by fluctuation of 3 half-wave length periods is not sensed as CHIRATSUKI, such as lighting, as a matter of fact. If actually adapted in such a view, the change of two heaters conventionally it was shown in drawing 8, if the subheater 5 was carrying out to the Maine heater 4 by the repeat of continuous half wave (S3) impression of N_s individual after continuous half wave (M3) impression of N_m individual like The heater change for every 3 half-wave length periods of this and equivalence It becomes the pattern which was shown in drawing 9 and which compounds energization (S2 in drawing 7 condition) like by the 2 half-wave lengths in 1 half-wave-length energization in 3 half-wave lengths of the Maine heater 4 (M1 in drawing 7 condition), and 3 half-wave lengths of a subheater, i.e., the energization pattern shown in M1+S2 condition of drawing 7. This energization pattern is a part for the half-wave length of $2 N_s - N_m$ individual (A section in drawing 9 > it continues.). [0039] Next, the pattern which compounds 2 half-wave-length energization (M2 in drawing 7 R) 7 condition) of the Maine heater 4 and 1 half-wave-length energization (S1 condition in drawing 7) of the subheater 5, i.e., the energization pattern shown in M2+S1 condition of drawing 7, performs half-wave length part impression (the B section in drawing 9) of $2 N_m - N_s$ individual. Such a repeat of the inside A of drawing 9 and the B section is equivalent to the conventional change pattern (drawing 8 R) 8). A repeat period when the reason puts the inside A and B of (1) drawing 9 at one period is a part for the half-wave length of a $N_m + N_s$ individual, and be conventionally the same as the case of a pattern (drawing 8).

[0040] (2) It of N_m and the subheater 5 is N_s , and that of the number of all the impression half waves of the Maine heater 4 of the inside A of drawing 9 and B circles conventionally the same as that of the number of energization half waves in 1 period of a pattern.

[0041] Conventionally, as compared with impression of a pattern, the calorific value of each heater is clearly more nearly equal than (3), (1), and (2), if it sees the whole period.

[0042] Furthermore, although it already said that an idea is advanced and the fluctuation in 3 half-wave length periods in [A] drawing 9 and inside B does not become a problem, the average current difference of the A section in the said drawing and the B section becomes a problem. However, if this amount is evaluated, the average current of A circles will serve as $I_m(1/3) + (2/3) I_s$, and the average current of B circles will serve as $I_m(2/3) + (1/3) I_s$. Therefore, the difference of Both A and B part is $((1/3) I_m + (2/3) I_s) - (2/3) I_m + (1/3) I_s = (1/3) (I_s - I_m)$.

It turns out that it is one third a next door and in conventional. (The stationary current value when impressing I_m here a Maine heater 4 HE

perimeter term and I_s are taken as it of subHITAHE.) The time of being $2 N_m \leq N_s$ is considered by the above-mentioned case of being special. In this case, the number of half waves of the B section of drawing 9 becomes negative. Then, as shown in drawing 10, the $3 N_m$ half-wave length part subheater 5 is made S2 condition impression, and the Maine heater 4 adds the wave made M1 condition impression, and impresses S tri-state of only the subheater 5 by the half wave ($N_s - 2 N_m$) after that. Even if it considers this case, a repeat period is $T = N_m + N_s$ (number of a half wave), and it by which the number of half waves impressed to the Maine heater 4 in that period T is impressed to N_m and a subheater is N_s , and is not different from the time of the conventional change. furthermore, A in drawing 10 and B' — the average current difference between the sections — $((1/3) I_m + (2/3) I_s) - I_s = (1/3) (I_m - I_s)$

It turns out that it becomes and has become one third in conventional (drawing 8).

[0043] What is necessary is just to think the same way in $2 N_s \leq N_m$. That is, although not illustrated, A' section in drawing 10 is considered to be S1+M2 condition, and B' section is considered to be M tri-state. Moreover, the number of half waves of A' section at this time is set to $3 N_s$ (es), and the number of half waves of B' section is set to $N_m - 2 N_s$. A' in this case, and B' — the difference of the average current between the sections — $((1/3) I_s + (2/3) I_m) - I_m = - (1/3) (I_m - I_s)$

Although a next door and a sign are reversed, it turns out too that the absolute value of a current difference is one third in conventional.

[0044] At saying that it rises from the condition that the average current is low, by thinning out a wave in the period of the 3 half-wave length with the gestalt of this operation in short at the time of heater starting, and the time of a heater change Within the period of three half waves, if the Maine heater 4 and the subheater 5 are switched at a rate of one half wave and two half waves (1 period) following it The source-effect frequency caused by the current difference between both heaters becomes high, and it can be said that CHIRATSUKI, such as lighting connected to the power source, uses as a result what no longer sensing for people's eyes.

[0045] Drawing 11 is a circuit diagram for realizing "wave number control" mentioned above.

[0046] The inside of this drawing and TH are temperature sensors (it is 6in drawing 1), and this is connected to resistance R1 and that partial pressure potential is inputted into analog input terminal A/D in CPU.), such as a thermistor which detects the temperature of a heater roller (1 in drawing 1). Analog-to-digital conversion of the signal given to the A/D terminal is carried out, and it is processed within CPU. The zero cross pulse (refer to drawing 13) corresponding to the zero crossing point of an

AC-power-supply electrical potential difference is inputted into the INT input terminal of CPU. This zero cross pulse is generated by a photo coupler PC 1 and Comparator COM based on the alternating-voltage input of a power source.

[0047] According to falling of a zero cross pulse, the interruption routine inside CPU (after-mentioned) is started, and the signals OUT1 and OUT2 which make the Maine heater 4 and the subheater 5 turn on to predetermined timing immediately after this zero cross signal falling, respectively are outputted.

[0048] For example, when OUT1 output is H level, the transistor TR1 was set to OFF and the luminescence side of phot triac PT1 has gone out. Since a phot triac is also OFF the light-receiving side of PT1 and the gate current of a triac T1 does not flow, a triac T1 will be in an OFF condition, and the Maine heater 4 will be switched off. In addition, in the gestalt of this operation, a transistor TR1, phot triac PT1, and a triac T1 constitute a "switching means."

[0049] On the contrary, when OUT1 is L level, actuation contrary to **** is carried out, a transistor TR1 turns on the light emitting diode of ON and phot triac PT1, and a phot triac turns it on a light-receiving side. Since the light-receiving side of PT1 flows, the gate current the ** style was carried out [gate current] by resistance R2 or R4 is supplied to the gate of a triac T1. Therefore, a triac T1 is flowed through it and turns on the Maine heater 4.

[0050] Connection of the resistance R6 and the capacitor C1 which were connected to juxtaposition at the triac T1 is the so-called snubber circuit, and when there is an abrupt change of supply voltage under the effect of an outpatient department noise etc., it is for preventing that a triac T1 turns on independently (the same is said of resistance R7 and a capacitor C2).

[0051] The flow of OUT2 output which controls lighting of the subheater 5 is the same as the above.

[0052] In the above, the example of the control performed by the explained circuit is explained. Here, although two energization patterns at the time of the change of the Maine heater 4 and the subheater 5 were made into condition A' of drawing 10, and the thing corresponding to B', according to the object to apply, it can consider as the combination of another energization pattern as shown in drawing 9.

[0053] Like, when the signal corresponding to the CPUA/D input value in drawing 11, i.e., the temperature of the heater roller 1, shown in drawing 12 has exceeded from target temperature, both the Maine heater 4 and the subheater 5 are OFF (when roller temperature is high). Moreover, like, when less, heater lighting control is carried out in the form which was shown in drawing 12 and which repeats condition a->b->c->d->e to f->e->f->e until

roller temperature exceeds a target temperature value. The condition a of these is in M1 energization (1 half-wave length ON in 3 half-wave lengths) condition of the Maine heater 4 shown in drawing 7 like mentioned above, and the subheater 5 is OFF. The Maine heaters 4 are [M2 energization (S2 wave in drawing 7) and the subheater 5 of Condition b] OFF. Conditions c are the Maine heater OFF and the subheater five S1. The Maine heaters 4 of Condition d are OFF and the subheater five S2.

[0054] Thus, current change of each heater to the rush current is made to ease in the Condition a, b, c, and d. Since it is the same as the contents shown in drawing 6 about this, it is as having already explained. Speaking of the repeat of the conditions e and f after it, the Maine heater 4 of Condition e is OFF, and the subheater 5 is the perimeter term ON (S3). The Maine heater 4 of Condition f is synthetic energization of the subheater five S2 in M1 energization. This pattern is as it having been the same as that of the pattern shown in drawing 7, and having also already explained this. In short, this is actuation for reducing change current change produced at the time of the change of the Maine heater 4 and the subheater 5.

[0055] The flow chart with which an example of the software procedure for realizing above-mentioned control is expressed to drawing 14 is shown.

[0056] It already described that the zero cross pulse shown in drawing 13 is given to the interruption input INT to CPU (drawing 11). By falling of this zero cross pulse, interruption actuation starts the processing in CPU and the procedure shown in the flow of drawing 14 is performed.

[0057] First, when an A/D input value is higher than target temperature, processing flows to the N side by decision S141, and each initial value 0 is set to Counters a, b, c, d, e, and f (S142). Moreover, 1 is respectively set to OUT1 and OUT2 (S143), and both the Maine heater 4 and the subheater 5 are turned off by this. Counters a, b, c, d, e, and f are counters which determine each duration of the conditions a, b, c, d, e, and f at the time of the heater ON shown in drawing 12, and they are managed with the number of zero cross pulses, i.e., the number of power-source half waves.

[0058] As mentioned above, although processing when roller temperature is higher than a target was described, if the value (temperature is low) than which the A/D input value was less from target temperature is shown, whenever interruption starts, it will judge within [S141] a flow, and processing will flow to the Y side shortly. At the time, 1 is added to the infanticide counter TO (S144). Whenever this infanticide counter TO passes this part of a flow by 0->1->2->0->1->2 and interruption, a condition continues the round of the condition of three one progress. When a counter value is set to 3, he is trying to return to initial value 0 by decision S145 (S146). This counter TO is processed [subsequent] and the duty of the directions pointer of of which location in 3 half-wave lengths to point out the

half-wave length is achieved.

[0059] By decision S147, the condition of a counter is seen, if the default value A defined beforehand is not reached, namely, if it is in a condition in drawing 1212, processing will flow to the N side and 1 ***** of a counters will be carried out (S138). Default value A is the number of a half wave [in / here / Condition a] (the same about other default value mentioned later). Next, by decision S149, the value of the above-mentioned infanticide counter TO is checked. If this value is 0, the Maine heater 4 is turned on (S150), and if it is the other values 1 or 2, the Maine heater 4 and the subheater 5 will be made into an OFF condition (S151).

[0060] It is at the time when heater temperature is lower than target temperature, and if the infanticide counter TO goes round (0->1->2->0->...) and a counter has not reached the default value A, the decision section S149 will be passed each time, and the Maine heater 4 will be periodically turned on by 1 half wave in three half waves at each time when falling of a zero cross pulse starts an INT input. In the decision section S149, it can be said that the energization condition M1 shown in drawing 7 is made. If a counter reaches default value A, it will end the condition a which showed in drawing 12, and will shift to Condition b. Namely, if the condition of b counter is checked within [S152] a flow and the default value B is not reached, processing flows to the N side, 1 count-up of b counter is done (S153), it thins out in decision S154, and the value of Counter TO turns on the Maine heater 4 only at the time of 0 or 1 (S155, S156). This can be said to be having realized the energization condition M2 shown in drawing 7.

[0061] as mentioned above, if it comes out so and is, c counter will be counted up one time by decision S158, it sees whether in the decision section S157, it is in c condition in drawing 12 similarly, the infanticide counter TO is seen (S159), when the infanticide counter TO is 0, only the sub heater 5 is turned on and S1 condition (inside of drawing 7) is realized (S160, S161). And in the following decision S162, d condition is judged and only five is made into Subheater 2 condition by decision S164 after 1 count-up (S163) of d counter (S165, S166). Furthermore, in the following decision S167, e condition is judged and let only the subheater 5 be S tri-state after 1 count-up (S168) of e counter (S169).

[0062] Above, a, b, c and d in drawing 12, and e condition are completed. That is, it means ending a series of standup section sequences shown in drawing 6.

[0063] In the following decision S170, it judges whether it is in f condition in drawing 12. While f counter does not reach the default value F, processing flows to the N side, counts up f counter one time (S171), is thinned out in decision S172, checks Counter TO, if the value is 0, turns on only the Maine heater 4 (S174), and turns on only the subheater 5 except it (S173). It will be

in a Maine heater M1 condition and the energization condition of refer to [of the form where subheater S2 condition was compounded] the inside of M1+S2< drawing 7 as a result.

[0064] Moreover, when this f counter reaches default value F, processing flows to the Y side by decision S170, and initial value 0 is re-set to e counter and f counter. consequently — since default value attainment of e counter of decision S167 will be canceled in the next INT interruption — once again — the e condition 5, i.e., a subheater, — ON (S tri-state) — becoming — f->e->f-> ... and these 2 conditions will be repeated.

[0065] Thus, it was shown that the lighting condition of the heater shown in drawing 12 is realizable.

[0066] In addition, after an a-f counter sets up those default value A, B, C, D, E, and F as initial value unlike the above, you may make it investigate whether each counter value amounted to 0 by carrying out the subtrahend.

[0067] According to the gestalt of the above operation, the following exceptional effectiveness is acquired.

[0068] (1) Control hardware becomes comparatively simple. For example, as a means to control the heater current, although a phase control method is generally held like, it is necessary to generate the pulse which specifies the phase angle (time amount in a time interval sufficiently shorter than the time amount of the half-wave length) which was mentioned above, and which should set up a timer from the zero crossing point of supply voltage in this case, and should turn on a heater. These have the fault that hardware, such as the complexity of the control [itself] and a timer style, must be prepared. If it is "wave number control" like this invention, since it is only turning on a heater on a zero cross origin, the timer which determines a phase becomes unnecessary. Moreover, the complexity on control, such as those setup and starting, decreases that much.

[0069] (2) Since the heater current is impressed from a zero cross origin in "wave number control", I hear that other advantages when comparing with phase control do not almost have the current change of a frequency with the high order power line period on power-source Rhine, and generating of the so-called power-source higher harmonic, and there are. Usually, although it was necessary for the heater and the serial to insert a mass inductance (choke coil) in order to press down generating of such a power-source higher harmonic wave, this had become the cause in which invites the cost rise by addition of an excessive electrical part, and the request of reservation of the installation bars miniaturization of a machine.

[0070] Above, although the example of a type about "wave number control" of this invention was shown, deformation of the following forms is also considered.

[0071] The example for easing the rush current was shown in drawing 6. for

example, ***** referred to as reducing the magnitude of current variation too even if there are no conditions b and d in this and it is the shift from 1/3 half wave to a perimeter term wave — it has fixed effectiveness. Similarly, there are no conditions a or c and, only also in Conditions b or d, the same thing can be said.

[0072] This invention contains ** in all the combination that can reduce an average current value by thinning out by the 1 or 2 half-wave lengths, and can reduce the magnitude of the rush current out of the period of 3 half-wave length units in short at the time of this starting just.

[0073] Although the example in mutual lighting of the Maine heater 4 and the subheater 5 and the so-called flicker ring lighting was shown in drawing 9

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the schematic diagram of a fixing assembly with which this invention is applied.

[Drawing 2] It is the graph which shows the exoergic intensity distribution of the Maine heater of the fixing assembly of drawing 1, and a subheater.

[Drawing 3] It is the timing chart showing an example of the energization condition of the Maine heater of the fixing assembly of drawing 1, and a subheater.

[Drawing 4] It is a timing chart for explaining energization of HITAE by phase control.

[Drawing 5] the current of a device — it is a circuit diagram for following electric and explaining the voltage variation to produce.

[Drawing 6] It is the current wave form Fig. showing an example of the wave number control at the time of heater starting in the gestalt of operation of this invention.

[Drawing 7] It is the current wave form Fig. showing the energization pattern used at the time of the change of the Maine heater in the gestalt of operation of this invention, and a subheater.

[Drawing 8] It is the explanatory view showing how to change the former of the Maine heater and a subheater.

[Drawing 9] It is the explanatory view showing the energization condition of the Maine heater and a subheater in the gestalt of operation of this invention equivalent to drawing 8.

[Drawing 10] It is the explanatory view showing the modification of the energization condition of the Maine heater of drawing 9, and a subheater.

[Drawing 11] It is the circuit diagram showing the circuit for realizing the energization condition of the Maine heater and a subheater in the gestalt of operation of this invention.

[Drawing 12] It is the explanatory view of the example of the control

performed by the circuit of drawing 11.

[Drawing 13] It is the explanatory view of the zero cross pulse of the supply voltage detected in the circuit of drawing 11.

[Drawing 14] It is the flow chart which shows an example of the interruption processing performed by CPU of drawing 11.

[Drawing 15] It is the wave form chart showing the modification of the gestalt of operation of this invention.

[Description of Notations]

1 [-- The Maine heater, 5 / -- A subheater, 6 / -- Temperature sensor.]
-- A heater roller, 2 -- A pressurization roller, 3 -- A form, 4

[Translation done.]

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CORRECTION OR AMENDMENT

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[Filing Date] December 21, Heisei 12 (2000. 12.21)

[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] Claim 9

[Method of Amendment] Modification

[Proposed Amendment]

[Claim 9] It is image formation equipment which has the fixing assembly which fixes a toner image on a form, The 1st and 2nd heaters as a fixing heater of said fixing assembly,

The 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively,

A temperature detection means to detect the heater temperature of said fixing heater,

A zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference,

The control means which determines the right or wrong of impression of said supply voltage of a half-wave length unit to said 1st and 2nd heaters in the procedure defined beforehand, and controls said 1st and 2nd switching means one by one based on this decision result at every zero cross by said zero cross detection means when it falls from the temperature as which the temperature detected by said temperature detection means was determined beforehand

Image formation equipment characterized by preparation *****,

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] 0025

[Method of Amendment] Modification

[Proposed Amendment]

[0025] The image formation equipment by this invention is image formation equipment which has the fixing assembly which fixes a toner image on a form, and is a fixing heater of said fixing assembly, **** 1 and the 2nd heater, and the 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively, When it falls from the temperature as which the temperature detected by temperature detection means to detect the heater temperature of said fixing heater, zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference, and said temperature detection means was determined beforehand, The procedure defined beforehand determines the right or wrong of impression of said supply voltage of a half-wave length unit at every zero cross by said zero cross detection means to said 1st and 2nd heaters one by one. It is characterized by having the control means which controls said 1st and 2nd switching means based on this decision result.

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0032

[Method of Amendment] Modification

[Proposed Amendment]

[0032] An example of "wave number control" by this invention is shown in drawing 6. This is carried out to the rush current section of a halogen heater. What is necessary is for the rush current section to be the standup section just behind Heater ON, and just to make it a current increase it gradually on the average. Therefore, in this example, it starts from the Main heater ON and a part for 1 time of the half-wave length is periodically energized to the appearance shown first at Period a at three half periods (this is called "1/3 half wave"). Next, as shown at Period b, a part for 2 times of the half-wave lengths is energized periodically at three half periods (this is called "2/3 half wave"). Then, only required time amount may energize the Main heater by the perimeter term (this is called a "perimeter term"). It does not illustrate. Then, although the Main heater 4 is switched off and energization of only the subheater 5 is continued, the period a of a perimeter term without infanticide comes first similarly the period c of 1/3 half wave next the period d of 2/3 half wave, and after that.

[Procedure amendment 4]

[Document to be Amended] Specification

[Item(s) to be Amended] 0059

[Method of Amendment] Modification

[Proposed Amendment]

[0059] By decision S147, the condition of a counter is seen, if the default value A defined beforehand is not reached, namely, if it is in a condition in drawing 12, processing will flow to the N side and 1 ***** of a counters will be carried out (S148). Default value A is the number of a half wave [in / here / Condition a] (the same about other default value mentioned later). Next, by decision S149, the value of the above-mentioned infanticide counter TO is checked. If this value is 0, the Main heater 4 is turned on (S150), and if it is the other values 1 or 2, the Main heater 4 and the subheater 5 will be made into an OFF condition (S151).

[Procedure amendment 5]

[Document to be Amended] Specification

[Item(s) to be Amended] 0083

[Method of Amendment] Modification

[Proposed Amendment]

[0083] In the following decision S170, it judges whether it is in f condition in drawing 12. While f counter does not reach the default value F, processing flows to the N side, counts up f counter one time (S171), is thinned out in decision S172, checks Counter TO, if the value is 0, turns on only the Main heater 4 (S174), and turns on only the subheater 5 except it (S173). It will be in a Main heater M1 condition and the energization condition of M1+S2 (refer to inside of drawing 7) of the form where subheater S2 condition was compounded, as a result.

[Procedure amendment 6]

[Document to be Amended] Specification

[Item(s) to be Amended] 0084

[Method of Amendment] Modification

[Proposed Amendment]

[0084] Moreover, when this f counter reaches default value F, processing flows to the Y side by decision S170, and initial value 0 is re-set to a counter and f counter, consequently — since default value attainment of a counter of decision S187 will be canceled in the next INT interruption — once again — the a condition 5, i.e., a subheater, — ON (S tri-state) — becoming — f->e->f-> ... and these 2 conditions will be reposted.

[Procedure amendment 7]

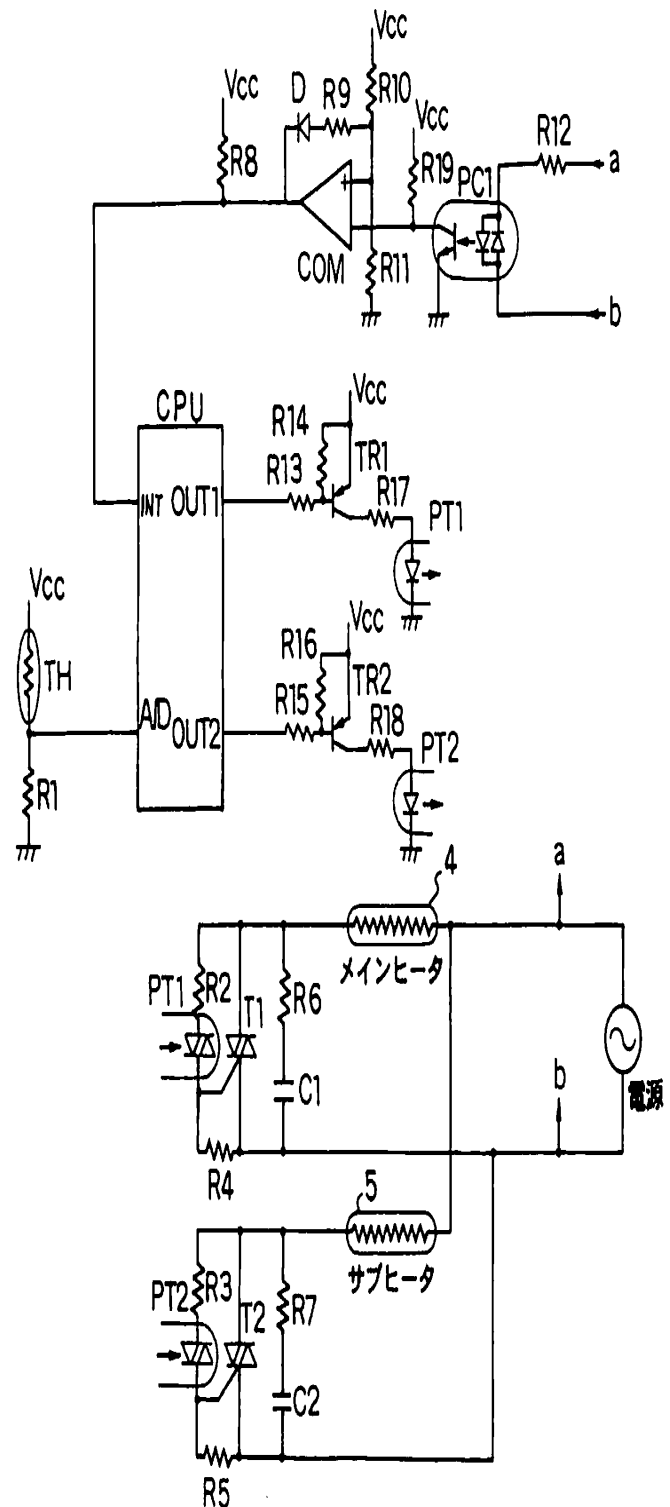
[Document to be Amended] DRAWINGS

[Item(s) to be Amended] drawing 11

[Method of Amendment] Modification

[Proposed Amendment]

[Drawing 11]



[Translation done.]